

***United States Court of Appeals
for the
District of Columbia Circuit***



**TRANSCRIPT OF
RECORD**

**BRIEF AND APPENDIX
FOR APPELLANT**

UNITED STATES
COURT OF APPEALS FOR THE
DISTRICT OF COLUMBIA

FILED JUL 29 1943

IN THE

Joseph W. Stewart
United States Court of Appeals CLERK

FOR THE DISTRICT OF COLUMBIA.

—
No. 8531
—

579

CORNING GLASS WORKS, *Appellant*,

v.

CONWAY P. COE, COMMISSIONER OF PATENTS,
Appellee.

—
Appeal from the District Court of the United States for the
District of Columbia.
—

VERNON M. DORSEY,
Attorney for Appellant.

CONTENTS OF BRIEF.

	Page
Jurisdictional Statement	1
Statement of the Case	1
The Statute	2
Statement of Points	2
Summary of Argument	3
The Yoshiki Application	3
The Claims on Appeal Exclude the Presence of Soda	4
The Holding Below is Erroneous	5
Argument	6
Disclosure of Hauman Patent No. 1,966,407	6
Hauman's Disclosure Does Not Exclude the Pres- ence of Soda	8
Hauman Teaches that Soda May be Intentionally Introduced	8
Hauman is Inoperative to Product His Desired Product Unless Soda is Present.....	9
Summary of Differences Between Hauman and Yoshiki	10
The Law as to the Certainty of Disclosure Necessary to Support Anticipation	10

AUTHORITIES.

Galogeropoulos, ex parte, 8 P. Q. 71.....	12
Haynes Stellite Co. v. Chesterfield, 22 Fed. (2d) 635..	12
Van Heuzen Products v. Earl & Wilson, 300 Fed. 922.	11

STATUTES.

The Statute the Basis of this Suit, 35 U. S. C., Sec. 63.	2
---	---

IN THE
United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA.

No. 8531.

CORNING GLASS WORKS, *Appellant*,

v.

CONWAY P. COE, Commissioner of Patents, *Appellee*.

BRIEF FOR APPELLANT.

JURISDICTIONAL STATEMENT.

This suit is brought under the provisions of Section 4915 of the Revised Statutes of the United States (U. S. Title 35, Sec. 63) to authorize the defendant as Commissioner of Patents to issue Letters Patent of the United States to the plaintiff on an application of Bunpei Yoshiki, and duly assigned to it. (Appellant's App. 2.)

STATEMENT OF THE CASE.

Bunpei Yoshiki, as inventor, filed in the United States Patent Office on September 9, 1937 an application for a Refractory¹ and a Method of Making the Same, Serial No. 163,159, which application was by an assignment, duly recorded on October 12, 1937, assigned to the plaintiff (Ap-

¹ These refractories are blocks cast from molten material and are used in building the walls of tanks in which glass is melted. The production by melting a batch and casting the block is well known technique. (Appellant's App. 15.)

pellant's App. 2). Thereupon, due proceedings were had and the Primary Examiner rejected the claims of the said application and his ruling was affirmed by the Board of Appeals of the Patent Office; whereupon this suit was filed within the statutory period (no appeal having been taken to the Court of Customs and Patent Appeals), (Appellant's App. 3), to secure method and apparatus claims (see these copied *postea*, pp. 4, 5).

At the trial the appellant produced as an expert witness, Thomas Estes Field, a graduate of Johns Hopkins University, who has, since 1935, been employed by the Corhart Refractories Company (the exclusive licensee under the Yoshiki application) in research on heat cast refractories (Appellant's App. 14, 15) and who had the physical Exhibit 2 cast in accordance with the teaching of the Yoshiki application (Appellant's App. 21). The witness Field testified as to technical facts relating to the process of making heat cast refractories and as to the raw material melted in their production. The trial Court held that two Hauman patents described the melting of the same materials as Yoshiki and resulted in the same product.

THE STATUTE.

Section 63 of Title 35, U. S. C., provides that an applicant dissatisfied with the decision of the Board of Appeals of the Patent Office, unless an appeal is taken to the United States Court of Customs and Patent Appeals, shall have a remedy by a bill in equity filed within six months from such decision and that a Court having cognizance thereof may adjudicate that the applicant is entitled to a patent.

STATEMENT OF POINTS.

The points relied on are: (Appellant's App. 35)

1. The Court erred in dismissing the Complaint on the grounds and for the reasons stated in the conclusions of law appurtenant to the above entitled cause.

2. The Court erred in not granting the plaintiff the relief sought by the Complaint.

3. The Court erred in holding that the ratio of ingredients set forth in the Hauman patents is identical with a ratio set forth by Yoshiki as being satisfactory for his purpose.

4. The Court erred in assuming that the application and the references used the same ingredients.

5. The Court erred in holding that one skilled in the art and following the teachings of Hauman would produce the results claimed by Yoshiki.

6. The Court erred in holding that the claims of Yoshiki are unpatentable in view of either of the Hauman patents.

7. The Court erred in failing to find that the true teaching of the Hauman patents is to embody in the batch prior to melting a percentage of alkali greater than 0.1 per cent.

8. The Court erred in failing to find that the product resulting from melting a batch containing less than 0.1 per cent is different in kind and character from the product obtained by one following the Hauman teachings.

Applicant's argument will be directed to the support of points 4, 5, 7 and 8 (i.e., the true disclosure of the Hauman patents) and if these points are well taken it necessarily follows that points 1 and 2 are also well taken, for it has not been denied that an invention was made by Yoshiki unless Hauman taught the use of an alkali-free batch.

SUMMARY OF ARGUMENT.

The Yoshiki Application.

1. The application here before the Court discloses (Appellant's App. 47) the process of melting a batch containing alumina, silica and magnesia and not containing over one-tenth of one per cent (0.1%) of alkali and allowing the mass to cool to produce a cast refractory product containing

mullite, corundum and cordierite. The specification gives the composition of a batch suitable for this purpose to be

Alumina	65 to 70%
Silica	25 to 28%
Magnesia	5 to 7%

The specification points out that prior to the filing of the application in 1937 the batches commonly used contained 1 per cent or over of alkali¹ and that as the result of the presence of the alkali the cooled melt consisted of mullite and corundum crystals bound by a glassy matrix.² The applicant then says that he seeks to replace the glassy binder with a binder of cordierite and this he accomplishes by reducing or eliminating the alkali content previously present in the melt.

As well known,

Mullite ($3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}$)	= Alumina	5.5%
	Silica	94.5%
Corundum (Al_2O_3)	= Alumina	100.0%
Cordierite ($2\text{MgO} \cdot 2\text{Al}_2\text{O}_3 \cdot 5\text{SiO}^2$)	{ Magnesia	20.3%
	{ Alumina	18.3%
	{ Silica	61.4%

The Claims on Appeal Exclude the Presence of Soda.

The claims formulated by applicant to state his invention, both process and apparatus, and denied by the trial Court are:

¹ Yoshiki here uses "alkali" in its more restricted and precise sense of an oxide of an alkali metal, (i.e., soda, potash) and not as including oxides of the earth metals (lime, magnesia, etc.). This is shown by the statement in his specification that "by reducing the *alkali* content * * * and adding *magnesia*, etc. Therefore, "alkali" used in the Yoshiki claims should be understood as including soda, potash, etc., and excluding lime, magnesia, etc. Attention is called to the following from Century Dictionary:

"ALKALI * * * In its restricted and common sense the term is applied only to the hydroxids of potassium, sodium, lithium, caesium, rubidium, and ammonium. In a more general sense it is applied to the hydroxids of metals of the alkaline earths, barium, strontium, calcium, and magnesium, and to a large number of organic substances, both natural and artificial, described under *alkaloid*."

² This is in accord with the teaching of the Hauman patent (to be later discussed) that such cooled melts consist of mullite and corundum unless a counterbalancing agent be also present.

1. The hereinbefore described method of producing a body containing mullite, corundum and cordierite which comprises melting a batch containing alumina, silica, and magnesia and being substantially free from alkali.

2. The hereinbefore described refractory product consisting of mullite and corundum crystals with a cordierite matrix.

3. The hereinbefore described refractory product consisting of mullite and corundum crystals bonded with cordierite.

4. The hereinbefore described method of producing a body containing mullite, corundum and cordierite and analysing less than 0.1 per cent alkali which comprises melting a batch containing alumina, silica, and magnesia.

5. The hereinbefore described refractory product consisting of substantial quantities of mullite and corundum crystals with a matrix substantially cordierite.

6. The hereinbefore described refractory product, consisting of substantial quantities of mullite and corundum crystals with a bond substantially cordierite.

The Holding Below is Erroneous.

The Court held that these claims were unpatentable in view of the Hauman patents 1,966,406 and 1,966,407 because "each suggests the proportions of a refractory article having as a 'ratio of important ingredients' the proportions of alumina, silica and magnesia disclosed by the applicant". (Appellant's App. 32.)

Applicant urges that while "*the ratio of important ingredients*" may be the same in Hauman as in the Yoshiki application neither (a) the *percentage composition* of the Hauman batch nor (b) the final products are the same as those of applicant. This arises from the fact that Hauman's composition contains (unlike applicant's) not only the magnesia, silica and alumina, but also over one-tenth of one per cent (0.1%) of an alkali, i.e., soda, the presence of

which prevents the formation (a) of a substantial quantity of mullite and (b) of cordierite, in the cooled mass. Applicant, being the first to appreciate the necessity of eliminating this alkali to obtain cordierite, is entitled to the product containing it and the method of making that product as called for in the claims.

ARGUMENT.

To reduce the length of the brief we will direct our argument to the Hauman patent No. 1,966,407 for the reason it was agreed by Counsel at the trial that the other Hauman patent No. 1,966,406 added nothing to the disclosure of patent No. 1,966,407 (Appellant's App. 20).

We have pointed out that applicant's claims are directed to

(1) a heat cast refractory consisting of mullite, corundum and cordierite;

(2) a method of producing such a refractory by melting and casting a proper mixture of alumina, silica and magnesia *not* containing over 0.1 per cent of alkali.

We will urge that the Hauman patents relied on by the lower Court (a) do not disclose, nor would one following their teachings produce, a refractory containing mullite in substantial quantities and cordierite, and (b) do not disclose the melting of a batch containing less than 0.1 per cent alkali but on the contrary one mixing the Hauman batch according to the Hauman teachings would include therein substantial quantities of alkali metal oxides (soda, potash).

Disclosure of Hauman Patent No. 1,966,407.

(Appellant's App. 17)

This is entitled "Corundum Products and Process of Producing the Same" and states that it relates to a modification of the old mixes (batches), which produced mullite

in excess of corundum, to *eliminate the mullite* and increase the corundum (page 1, lines 1 to 20).

Then it points out that the prior art recognized that the corundum crystals which might initially form on the beginning of cooling are re-absorbed during the subsequent formation of the mullite (page 1, lines 45 to 58)¹ and states that his (Hauman's) discovery is that the re-absorption of the corundum crystals and the formation of mullite may be prevented by the use of a counterbalancing agent, namely, any one of the alkaline earth oxides (magnesia, etc.) or *alkali metal oxides* (soda, etc.) or both (page 1, lines 59 to 84).

After describing his final product as consisting of corundum crystals bound together by a black glass (page 2, lines 50 to 65) Hauman says (p. 2, lines 135-148):

"In the practice of my invention I proceed as follows: A mixture of raw materials is prepared consisting of aluminous ore, such as Bauxite or diaspore, silica sand, and a counterbalancing or absorption preventing agent such as magnesia, so proportioned as to give the following *ratio of important ingredients*:

"Al ₂ O ₃	70
"SiO ₂	25
"MgO	5"

Attention is called to the words "ratio of important ingredients". Such a ratio may or may not be the same as percentage of the specified ingredients in the refractory. To illustrate, if one adds to a batch (having the proportion of important ingredients specified by Hauman) small quantities of other ingredients, while he will not change the original proportion of important ingredients, he will obtain a mixture whose percentage composition will not include the important ingredients in the percentages specified. Hence this statement by Hauman does not preclude the presence of substances other than silica, alumina and magnesia.

¹ This is a correct statement. (See Field's testimony Appellant's App. 15 and 16.)

Hauman's Disclosure Does Not Exclude the Presence of Soda.

Indeed Hauman tells us that these other substances are present, for he describes (p. 2, lines 50-65) his end product as consisting of corundum crystals bound together by a black glass, and on lines 85 to 88 of page 2, he gives its percentage of composition as alumina 30 per cent; silica 50 per cent; counterbalancing agent 10 per cent; "*the remainder* (i.e., 10 per cent) being impurities". We have here a plain statement that there are things in Hauman's mix other than silica, alumina and magnesia. Field (Appellant's App. 18), from the figures found in the Hauman specification, says that the actual *percentage* composition of the Hauman batch would be

Alumina	68.2%
Silica	24.4%
Magnesia	4.9%
Impurities	2.5%

We make no point as to the differences in the "proportion of Hauman's important ingredients" (silica, alumina and magnesia) so found by Field and those given by Hauman, but do stress the presence of 2.5 per cent of "impurities" which may be anything (including soda) and contend that, in the normal carrying out of the Hauman process, substantial quantities of soda would, as a matter of fact, be included in these "impurities". The reason for this is that the materials specified by Hauman (bauxite or diaspore) as furnishing his alumina content are natural raw earths and generally and usually contain 3 per cent or more of soda, only selected specimens being soda free (Appellant's App. 18).

Hauman Teaches that Soda May Be Intentionally Introduced.

Hauman gives no instructions to avoid such soda containing materials. On the contrary he indicates that the introduction of soda thereby is not detrimental to his prod-

uct, but that soda may be intentionally introduced as a counterbalancing agent. We quote from lines 78 to 84, page 1 of his specification—

“Such agent may be any of the alkaline earth oxides, as the oxides of beryllium, magnesium, calcium, barium, and strontium, *or it may be any of the oxides of the alkali metals such as potassium, sodium, lithium, rubidium, and caesium, or any combination of these two oxide groups.*” (Italics ours.)

Again he says (page 3, lines 16 to 19):

“I have found that the addition of the *alkali* and/or alkaline earth oxide to the melt might be lowered with similar results in a furnace of small dimensions.”

Hauman is Inoperative to Produce His Desired Product Unless Soda is Present.

Not only is there nothing in the Hauman specification indicating that the sources of alumina should be of low alkali content, but Field tells us that the 5 per cent magnesia given by Hauman will not of itself have sufficient counterbalancing effect to achieve the end desired by Hauman (Appellant's App. 19) i.e., the preservation of the corundum crystals after their formation.

It is quite evident therefore that Hauman intended one to use a soda bearing bauxite or diaspore. Field tells us (Appellant's App. 16) that the alkali earth of oxides, soda, etc., are many times more effective as counterbalancing agents than the alkali earth oxides (magnesia, etc.).

It is true that Field produced Exhibit 2, which is the Yoshiki refractory, by melting silica, magnesia and bauxite, but in so doing he instead of using the ordinary bauxite of commerce carefully picked his bauxite to be of low soda content after analysing it (Appellant's App. 18) and then as he expresses it (Appellant's App. 22), “We selected a particular bauxite and obtained the maximum alkali permitted by Yoshiki and we got by by the skin of our teeth”.

Summary of Differences Between Hauman and Yoshiki.

Thus we find that:

<i>Hauman</i>	<i>Yoshiki</i>
proposes to produce a product consisting of corundum and glass and substantially free from mullite	proposes to produce a product consisting of corundum, <i>mullite</i> and <i>cordierite</i>
by melting a batch of natural raw materials <i>normally containing substantial percentages of soda</i> , with a specific statement that additional soda may be added as such as a counterbalancing agent if the amount of magnesia present is insufficient to obtain his result, his specification indicating in terms the presence of impurities in the raw material, and the presence of soda among these impurities being necessary to produce his product.	by melting a batch <i>substantially free from soda</i> .

The Law as to the Certainty of Disclosure Necessary to Support Anticipation.

We recognize that the test of what constitutes invention has by recent decisions been rendered more strict than it was at an earlier time, but we have no such question in this case; for here the holdings against patentability have not been bottomed on what constitutes invention but on whether one following the Hauman teachings would use "soda-free" raw sources of alumina, and hence would obtain applicant's product. We will not therefore discuss what mental activities are, under the recent decisions, necessary for patentability, but only the law as to the nature of disclosure required in a prior art patent to constitute it an anticipation.

We submit that the rule is that the disclosure must be

such that one following the teachings of the patent in the light of the art as it stood, in an endeavor to produce what the patent seeks to accomplish, will inevitably do that what is substantially claimed in the patent in suit, without chance entering into the result. This is the rule laid down by Judge Learned Hand in *Van Heuzen Products v. Earl & Wilson*, 300 Fed. 922. There the patent related to the production of the non-wilting semi-soft collar, once so popular for summer wear. The specific feature on which novelty was urged was "the use of multiple-ply interwoven fabric in the neck band or in the flap closely enough woven to make it stiff (page 925). The art relied on to anticipate was a patent to Willard. Judge Hand said (pp. 930, 931):

"To this I answer that, if it were true that any multiple-ply interwoven fabric made into a collar would, in Bolton's words, inevitably 'maintain its shape without the employment of starch,' I should say that Willard's disclosures were an anticipation, because one had only to practice it as it reads and one would get the present collar. But this is not the truth. Willard had no such purpose in mind, and one might go on forever following his patents, without ever making a starchless stiff collar. True, one might by accident hit upon a properly close weave and interweave, but it would only be by accident. To be a proper anticipation, a reference must go further than that: it must tell you how you can get with certainty the result you are after.

"The criticism of Bolton's own patent is indeed plausible, just because in this respect his disclosure is so scanty, though, for the reasons I have given, it does not persuade me. But as respects Willard I have no doubts whatever. He at least said nothing about getting a stiff collar, and it was hit or miss, if you followed him, what you would get. That will not do for an anticipation. *Eibel Process Co. v. Minn., etc., Co.*, 261 U. S. 45, 43 Sup. Ct. 322, 67 L. Ed. 523; *Pyrene Mfg. Co. v. Boyce* (C. C. A. 3) 292 Fed. 480. The principle, as Judge Woolley says, is akin to that of a lost art (*Gayler v Wilder*, 10 How. 477, 13 L. Ed. 504), because that which casually appears without any conscious di-

rection will not reappear, except under the doctrine of chances. Nobody is the better for it, because nobody knows how to get it again, till some one arrives who not only makes the thing, but wants to make it, and knows that he has made it. *Wickelman v. A. B. Dick Co.* (C. C. A. 2) 88 Fed. 264, 31 C. C. A. 530; *Hillard v. Fisher Typewriter Co.* (C. C. A. 2) 159 Fed. 439, 86 C. C. A. 469."

The same rule as to certainty versus chance was applied by the 6th Circuit Court of Appeals in *Haynes Stellite Co. v. Chesterfield*, 22 Fed. (2d) 635 in which the Court had before it the Haynes stainless steel patent directed to using cobalt with any two metals of the chromium group.

In discussing the patent to Leffler set up in anticipation the Court, speaking through Judge Dennison, said (p. 637):

"Leffler thought he could use two or more, and seemingly any two or more, of his lists of metals. He would have therefore satisfied his disclosure if he had put nickel and cobalt into his iron without any chromium, *or if he had put in tungsten or chromium without any cobalt, or if he had put in copper or lead without cobalt or chromium. Such hit or miss reference does not disclose the combination of cobalt and two of the chromium group.*" (Italics ours.)

Again, on the same page in discussing a Thompson patent the Court said:

"Thompson again shows a vague proposition by one who names a list of metals, *among which he is to have unrestricted choice, and who points out none of the distinctions which must govern that choice in order to approximate Haynes' alloy.*" (Italics ours.)

The same rule as to the necessity of certainty was applied by the Board of Appeals in the Patent Office. We are aware that this is an inferior tribunal but the facts are so pertinent to the present case that we think we should quote from it. The case in question was that of *ex parte Galo-*

geropoulos, 8 P. Q. 71, in which the claim before the Board was very much in the form of one of the claims here. It read:

“As a new article of manufacture, a casting of aluminous cement containing less than 1.5% of iron and having a polished translucent surface.”

Applicant in his specification had stated that with this low iron content the surface of the product would be translucent. The act relied on to anticipate showed castings made from ordinary cement and not having translucent surfaces, such cements generally containing 5 to 15 per cent of iron. It was, however, known that by proper treatment the iron could be reduced to 1.5 per cent. The Board held the claim patentable.

It is respectfully submitted that the decision below was erroneous and should be reversed.

Respectfully,

VERNON M. DORSEY,
Attorney for Appellant.

APPENDIX

INDEX TO APPENDIX.

	Page
Complaint	2
Answer	4
Statement of Evidence	5
Colloquy of Court and Counsel	5
Opening Statement for Plaintiff	6
Opening Statement for Defendant	12
Testimony of Theodore Estes Field	14
Memorandum of Trial Court	31
Findings of Fact	32
Conclusions of Law	33
Judgment	34
Statement of Points to be Relied on Appeal	35
Stipulation of Record	36
Hauman Patent No. 1,966,406	39, 40, 41
Hauman Patent No. 1,966,407	42, 43, 44, 45
Plaintiff's Exhibit No. 1, File Wrapper of Yoshiki Ap- plication	47

IN THE

United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA.

No. 8531.

CORNING GLASS WORKS, *Appellant*,

v.

CONWAY P. COE, COMMISSIONER OF PATENTS,
Appellee.

Appeal from the District Court of the United States for the
District of Columbia.

APPENDIX TO BRIEF FOR APPELLANT.

I.

**PLEADINGS, DOCKET ENTRIES AND OTHER PAPERS
DESIGNATED BY APPELLANT.**

1 Endorsed: Filed Nov 7 1941 Charles E. Stewart,
Clerk.

In the District Court of the United States
for the District of Columbia.

Civil Action No. 13567.

CORNING GLASS WORKS, Corning, New York, Foot of Walnut
St., *Plaintiff*,

v.

CONWAY P. COE, Commissioner of Patents, *Defendant*.

Complaint

(To authorize issuance of Letters Patent)

1. This action arises under Section 4915 of the Revised Statutes of the United States (35 U. S. C., Title 35, Sec. 63), as hereinafter fully appears. Defendant as Commissioner of Patents has an official residence in the District of Columbia and is in the jurisdiction of this Court.

2. Bunpei Yoshiki, a subject of the Emperor of Japan, residing at Tokyo, Japan, being the inventor of certain new and useful improvements in "Mullitic Cast Refractories Having an Extremely Low Co-efficient of Thermal Expansion", and being entitled to file an application for Letters Patent thereon, and having complied with all the requirements of the statutes in such cases made and provided and with the rules of the United States Patent Office, duly filed on September 9, 1937, as Serial No. 163,159, an application for United States Letters Patent for the said invention.

3. That by an assignment duly recorded in the United States Patent Office on the 12th day of October, 1937, in Liber L-172, pages 21, 22, said Yoshiki assigned all his rights in and to said application to the plaintiff.

2 4. That in said application a certain invention patentable to the plaintiff, was set forth in the following claims:

1. The hereinbefore described method of producing a body containing mullite, corundum and cordierite which comprises melting a batch containing alumina, silica, and magnesia and being substantially free from alkali.

2. The hereinbefore described refractory product consisting of mullite and corundum crystals with a cordierite matrix.

3. The hereinbefore described refractory product consisting of mullite and corundum crystals bonded with cordierite.

4. The hereinbefore described method of producing a body containing mullite, corundum and cordierite and analysing less than 0.1% alkali which comprises melting a batch containing alumina, silica, and magnesia.

5. The hereinbefore described refractory product consisting of substantial quantities of mullite and corundum crystals with a matrix substantially cordierite.

6. The hereinbefore described refractory product, consisting of substantial quantities of mullite and corundum crystals with a bond substantially cordierite.

and a patent upon said invention as so expressed was duly demanded by said application, the application was duly prosecuted in accordance with the Statutes of the United States and the Rules of the Patent Office in such cases made and provided, but said claims were finally rejected by the Primary Examiner and his action affirmed by the Board of Appeals on or about May 10, 1941 and petition for reconsideration denied May 26, 1941.

5. No appeal has been taken to the United States Court of Customs and Patent Appeals from any action in the United States Patent Office in said application.

Wherefore, plaintiff demands judgment that it is entitled, according to law, to receive a patent for his invention

3 as specified in his claims, or for any part thereof as
the facts in the case may appear.

CORNING GLASS WORKS,

By GEORGE D. MACBETH,

Vice President

VERNON M. DORSEY,

1346-F Street, N. W.,

Washington, D. C.

Solicitor.

* * * * *

4 *Answer to the Complaint.*

To the Honorable the Justices of the District Court of the
United States for the District of Columbia.

1. Defendant admits the allegations of paragraph 1.

2. He admits that on September 9, 1937, Bunpei Yoshiki, claiming to be the inventor of certain alleged new and useful improvements in "Mullitic Cast Refractories Having an Extremely Low Coefficient of Thermal Expansion", filed in the Patent Office an application for patent thereon, to which application Serial No. 163,159 was given. He admits that said applicant was entitled to file the application and that said application was in compliance with the requirements of law and the rules of the Patent Office.

3. He admits the allegations of paragraph 3.

4. He admits that said application contains claims 1, to 6, inclusive, which are directed to the alleged invention and are as set out in paragraph 4. He denies
5 that the subject-matter of said claims is patentable.

He admits that said application was duly prosecuted in the Patent Office, that said claims were finally rejected by the primary examiner and the rejection thereof was affirmed by the Board of Appeals in decisions rendered on May 10, 1941, and May 26, 1941. He denies that the plaintiff is lawfully entitled to receive a patent containing any of said claims since it is deemed that the said claims are unpatentable in view of the following prior patents and for the rea-

sons given in the statement of the examiner in answer to the appeal and the decision of the Board of Appeals, copies of which will be furnished at the trial:

Hauman,	1,966,406,	July 10, 1934,
Hauman,	1,966,407,	July 10, 1934.

Profert of copies of these patents is hereby made.

5. He admits the allegations of paragraph 5.

W. W. COCHRAN

*Solicitor, U. S. Patent Office,
Attorney for Defendant.*

November 25, 1941.

I hereby certify that a copy of this Answer to the Complaint was mailed today, November 25, 1941, to the attorney for plaintiff, Vernon M. Dorsey, 1346 F Street, N. W., Washington, D. C.

W. W. COCHRAN

Solicitor.

* * * * *

II.

TESTIMONY AND PROCEEDINGS DESIGNATED BY APPELLANT.

8

Washington, D. C.,
Tuesday, January 26, 1943

The above-entitled cause came on for trial before the Honorable Oscar R. Luhring, one of the Justices of said Court, sitting in Civil Division No. 6, at 11 o'clock a. m.

Appearances:

Vernon M. Dorsey, Esq., and
Albert L. Krey, Esq., for plaintiff.
E. L. Reynolds, Esq., for defendant.

Proceedings

The Court: The applicant is an alien enemy. Is there any question about his right to prosecute this case?

Mr. Reynolds: The case is assigned to Corning Glass Works; but it was assigned years before Pearl Harbor.

The Court: It has taken a long time to get here, then.

Mr. Dorsey: It has taken a long time to get here;
9 but there has not been any intentional delay in the prosecution of the case.

The Court: All right.

Opening Statement on Behalf of Plaintiff

Mr. Dorsey: This case is, of course, the ordinary proceeding under section 4915, where the Commissioner of Patents finds no invention over the prior art.

Th invention relates to what is known as a heat cast refractory.

The Court: Say that again.

Mr. Dorsey: A heat cast refractory.

About ten years ago—more than that, twelve years ago—there was introduced into the art a method of making refractory blocks for glass furnaces by melting mixtures at temperatures of 2,700, 2,800, or 2,900 degrees Fahrenheit and casting them to shape. They were very successful blocks and they have gone into very extensive use. They were introduced by the licensee under this application, the Corhart Refractories Company.

When you melt a mixture consisting of some seventy-odd per cent alumina, twenty-odd per cent silica, and the remainder magnesia and the impurities that are always present in glass, on cooling down that mass, from the molten mass there is, first, separation of corundum crystals
10 (crystals of alumina, pure alumina); and then, at the next stage of cooling, there is a separation of mullite crystals, which are alumina silicate. The crystal formation goes on until the liquid that is left becomes so viscous that no more crystals are formed; and then it solidifies as glass.

So that, as the end result, you have a cast block which is, maybe, six feet long, three or four feet wide, and a foot and a half thick, made up of the glassy mass in which are em-

bedded these new crystals of corundum and mullite. The amount of the corundum and the amount of the mullite that is formed is going to depend a great deal upon the composition that you originally melt, that is to say, if you have a large quantity, a certain amount, of alkalies, those alkalies affect the relative amounts of corundum and mullite that are formed.

Now, this application has for its object to produce an end product consisting not only of mullite and corundum and the glass matrix, but also cordierite interspersed in the glassy mass—cordierite being an aluminum-magnesium-silicate.

The advantage of that, your Honor, is that—

The Court (interposing): That is all included in your finished product, is it?

Mr. Dorsey: That is all included in our finished product.

Will you just hand me a piece of that to show his Honor?

(The sample which later became Plaintiff's Exhibit 2 was exhibited to the Court.)

11 The Court: That is your commercial product?

Mr. Dorsey: That shows the commercial product; but this is merely a test piece. That is what we get, your Honor, on a large scale.

The Court: And predominating in that is the glassy thing that you were telling me about?

Mr. Dorsey: No. The corundum and the mullite predominate; and those are those little crystals you see there; and these little crystals you see in the center are corundum. The corundum crystals are formed in here (indicating). They are interspersed all through the mass.

The Court: I see.

Mr. Dorsey: Now, the advantage of having the cordierite is that it has a very low coefficient of thermal expansion; and therefore it tends to prevent spalling, because those things are so dense, as you can see, your Honor, that if they are heated in the furnace they are very apt to spall, or have pieces crack off them, due to their density and the fact that

the usual matrix has a high coefficient of thermal expansion. The cordierite as the matrix, instead of the usual glassy matrix, tends to reduce that expansion and the cracking.

The specification, your Honor, in this case is so short that I have just had it copied, along with the claims, and I will pass the copy up to you. We will have a certified copy, of course, to offer in evidence; but I will hand that to
 12 your Honor. Now then, that is so short that I think if your Honor reads it you can very quickly get what we are asking for.

The Court (after reading): Yes.

Mr. Dorsey: Your Honor will not that there are six claims. Four of them, I believe, are on the process and two are on the end product.

The Court: Do you want to stand on all of them or dismiss some of them?

Mr. Dorsey: Claim 4 is on the process and claim 5 is on the product. They are very short.

The Court: Are you insisting on all those claims? Are you insisting upon all of them?

Mr. Dorsey: I am going to talk about all six of them.

The Court: You have the right to dismiss as to some of them.

Mr. Dorsey: At the present time I see no reason for dismissing as to any of them.

The Court: All right.

Mr. Dorsey: Now, your Honor will not that the composition of the batch that is to be melted is given in the specification there.

The Court: Before you get into that, tell me what you use that for. What is the commercial use of it? You have this block, of course, and have it in any form you want it. What is it mainly used for?

Mr. Dorsey: In glass furnaces and making the
 13 walls of the furnaces in which the glass is melted.

The furnaces are very large, bath tubs you might say, holding as much as seventy tons of glass, built of

enormous blocks. They contain the molten glass and they are subjected to very high temperatures and to the corrosive action of the glass itself at those temperatures. And for that purpose they have become quite an established product.

Your Honor will note that the composition which we melt, given at the bottom of the first page of that copy, is alumina 70 per cent, silica 25 per cent, and magnesia 5 per cent. I am selecting the second composition given. Your Honor will see why.

There are two references cited by the Patent Office against the case. They are the two patents to Hauman.

(The document which became Defendant's Exhibit 1 was handed to the Court.)

I will call your attention to page 2, bottom of the second column, of patent 1,966,407—

The Court (Interposing): What is the name? Hauman?

Mr. Dorsey: Hauman.

The Court: Hauman patent 1,966,407?

Mr. Dorsey: Yes.

The Court: 1,966,407?

Mr. Dorsey: Yes.

The Court: The second page?

14 Mr. Dorsey: On the second page, at the bottom of the second column, your Honor will find some figures given there. And I am going to say right now that they are identical with the figures given in column II on the bottom of the first page of the copy of our application.

The Patent Office position is that the mere fact that Mr. Hauman does not say anything about the formation of cordierite does not confer patentability if we start with the same composition that he starts with. And our point is that Hauman does not start with the same composition we start with.

Now, if your Honor will note, those figures are not given by Hauman as the percentages of the mass itself. They are given as the relative proportion of the essential in-

gredients. He says "so proportioned as to give the following ratio of important ingredients."

Now, as a matter of fact, there is something else present; and Hauman tells us there is, because, on line 85 of page 2, he says:

"Such glass contains approximately 30% alumina, 50% silica, and 10% counterbalancing agent, the remainder being impurities."

Now, the three things he names amount to 90 per cent; and that leaves 10 per cent of the glass to be accounted for as impurities.

The Court: Line 85, page 3?

Mr. Dorsey: Yes:

15 "In a typical mix, such glass contains approximately 30% alumina, 50% silica, and 10% counterbalancing agent, the remainder being impurities."

Now, the glass itself—

The Court (interposing) I do not find it.

Mr. Reynolds: On page 2, your Honor.

The Court: Oh. I see it now.

Now, what is the additional ingredient you claim this contains?

Mr. Dorsey: That is what we are fighting about. We say they are alkalies. You see, there is 10 per cent of impurities in that glass. The specification says the glass contains the following ratio of the important ingredients, 70 per cent of alumina, 25 per cent silica, and 5 per cent magnesia; and, according to the statement just read, there remains in the glass 10 per cent that constitutes impurities.

We say that those impurities are alkalies, for two reasons: One is that Hauman says, on line 135, page 2, that in carrying out his invention he proceeds to take—

"a mixture of raw materials* consisting of aluminous ore, such as Bauxite or diaspore, silica sand, and a counterbalancing or absorption preventing agent, such as magne-

sia, so proportioned as to give the following ratio of important ingredients;"

Now, we say that those ores, nine out of ten of
16 them, all contain impurities, and particularly alkalies. We say further that Hauman could not get the end product he is aiming for, which is this block substantially free from mullite formation, without those alkalies. He claims euhedral crystals of corundum interspersed in a glassy matrix with little or none of mullite.

Now, we will prove by our expert that the only way that you can avoid the formation of that mullite is to use those raw materials which naturally, and do, contain substantial quantities of alkali; and that is what Hauman was aiming for.

Now, your Honor, that is all the outline of my case. If there is anything else you would like me to explain, I would be glad to do it.

The Court: You emphasize the magnesia, don't you?

Mr. Dorsey: We, both of us, have magnesia, your Honor. That is necessary.

The Court: In either formula?

Mr. Dorsey: Yes.

The essential point is that we have got to start with one-tenth of one per cent or less of alkali. I am making a distinction between the raw materials that we use and the alkaline earths used by Hauman. Both of us have some alkali content.

The Court: Too much alkali would produce what?

Mr. Dorsey: If we had too much alkali, we would not get the mullite. By having too much alkali, Hau-
17 man does not get the mullite; and he so states.

So, therefore, we argue that, inasmuch as the materials he would naturally use would contain these impurities, and inasmuch as he could not get the result he is aiming for without using those impurities, his specification teaches the use of those impurities.

The Court: Because he has not mentioned the percentage of alkali you specify, and because he has mentioned those impurities you spoke of, you claim that this Hauman patent is not a reference against your application?

Mr. Dorsey: Yes, your Honor; the Hauman patent is not a reference.

The Court: You say that he should have mentioned the natural result of the combination of these various ingredients which you obtain?

Mr. Dorsey: No, your Honor, it is not the natural result. We will show by Mr. Field that the aluminous ores are a very indefinite kind of thing, dug out of the ground, and that most of them contain substantial quantities of alkalies; and that you have to hunt around and carefully pick if you are going to get an alkali-free aluminous ore. The finest grades of Bauxite satisfied that condition; but diaspore does not satisfy it. Diaspore very frequently runs up to three per cent alkali.

18 *Opening Statement on Behalf of Defendant*

Mr. Reynolds: If your Honor please, as has already been indicated, the specification of this application is very short; and it is not entirely definite. The only definite thing it teaches, really, is that the alkali content should be kept below one-tenth of one per cent. There is no teaching of the temperature conditions or cooling conditions, or anything like that, that are being carried out with the batch. He simply gives us some typical compositions of the batch and he says that the alkali content should be under one-tenth of one per cent; and he says you get cordierite if you do that. If that is the teaching at all, it must be on the assumption that if you follow out this you will get cordierite.

Obviously, if you have to do some particular procedure at a particular temperature, he has not told us about it. So we have got to assume that if you use that in the ordinary way you will get this product that he has.

Now, that composition, as is admitted, is exactly what is given by the Hauman patents. It is true that they say

that the percentages given are those of the important ingredients, that they do not say those are the percentages of the entire batch; but they add up to 100 per cent. But in other places in the specification, Hauman refers to silica, for instance, as being up to 25 per cent; and that is exactly what is given in the tables. And so I think the suggestion

is that those are substantially the proportions of the materials in the batch; and, if there are any impurities there, they are incidental and to such a small extent that there is no reason to suppose that they will interfere with the action. That being the case, since he starts with the same thing and follows out the typical process, we do not understand why he will not get the same thing the applicant suggests.

It is suggested that Hauman wants to eliminate mullite. Well, he does not want to eliminate it entirely. He says, for example, that, as a matter of fact, the mullite might be present in an amount up to 15 per cent and still give a product which is commercially useful. In other words, he has a right to use mullite in there; and, since he is using the same things and there is some mullite left, I do not see why we should assume there is enough alkali in there to take it out, to make a distinction.

In patent 1,966,407 Hauman mentions magnesium, which is one of the elements used by both plaintiff and Hauman and is what is called an alkaline metal earth—also sodium and potassium, which are alkaline metals. He says in his patent:

“The selection of the balancing agent depends upon the characteristics wanted in the ultimate glass. If a glass of high melting point is wanted, one or more members of the alkaline earth group will be used. If a glass of low melting point is wanted, one or more members of the alkali group will be used.”

Then he follows that by saying that if you want a glass of medium melting point, “one or more mem-

bers of the alkaline earth oxide group may be combined with one or more members of the alkali group."

That is what the plaintiff says he is doing in his compositions; and, therefore, when he puts alkali in he simply has a mixture of the two. If he wants a high melting point he will use the alkaline earths. So I think it is clear that he does not have alkaline earth in there. He certainly does not mention any in there. So far as I can see, there is nothing there to indicate that. We certainly do not assume that everything is in there simply because he does not say that it is not. He says here "important ingredients"; and we do not think there is any reason for assuming that he has got those alkalies in there; and it would appear that, since he uses the same ingredients and follows the same procedure, he will get the same product.

Thereupon Theodore Estes Field, a witness for the plaintiff, was first duly sworn by the Assistant Clerk, and then assumed the witness stand and was examined and testified as follows:

Direct Examination

By Mr. Dorsey:

Q. 1. State your name, age, residence, and address. A. Theodore Estes Field; 34 years old; 1360 Eastern Parkway, Louisville, Kentucky.

21 Q. 2. You are employed, are you not, by Corhart Refractories Company, of Louisville, Kentucky? A. I am.

Q. 3. And that company is licensee under the application here before the Court? A. Yes.

Q. 4. How long have you been employed by the Corhart Refractories Company? A. Seven years.

Q. 5. And in what capacities? A. Seven and a half years; the first three years as head of chemical research and since that time as director of research.

Q. 6. What training have you had qualifying you to testify in this case? A. I received a degree of doctor of philosophy in Johns Hopkins University in 1934. Since 1935 I have been employed by the Corhart Refractories Company on research on heat cast refractories of the nature here considered.

Q. 7. You heard Mr. Reynolds' remarks about the shortness of the Yoshiki specification, that it did not give any instructions as to the temperatures used in melting and cooling the product; and I will ask you whether that was accepted practice in the art when Yoshiki filed his application. A. In the case of these refractories, the temperature of melting—the temperature of casting is that of melting; and in the art to which he refers the materials are melted and cast at their melting point and allowed to solidify; and he suggests that the process is aided by very slow cooling to get a maximum development of the cordierite.

Q. 8. That was a well known technique taught in the art, wasn't it? A. Yes.

Q. 9. Tell the Court about what temperature was necessary to melt and cast it. A. This material would melt at around 1800 degrees Centigrade.

Q. 10. And that is about how much Fahrenheit? A. That would be 3400 degrees Fahrenheit.

Q. 11. Now tell the Court what happens when the liquid resulting from a mixture of alumina, silica, and an oxide of an alkali metal such as potassium is allowed to cool. A. If there are several ingredients present in the proportions which are here of interest, the first crystal phase separating from the melt would be pure alumina in the alpha form, known as corundum. At a later stage—

By the Court:

Q. 12. At what temperature would you reach that? A. It would start immediately at the melting point and progressively decrease; and as the temperature falls more and more corundum comes out.

23 At a later stage alumina and silica will separate together in the crystal form of mullite, which is an aluminum silicate. This crystallization will continue until the liquid which is left, due to the cooling, becomes so viscous that no further crystallization can occur.

The remaining liquid then freezes as a glass, which is entirely non-crystalline.

Depending on the amount of alkali present, more or less of the first form, corundum, will redissolve during the mullite separation. The amount of corundum which disappears decreases as the alkali is increased.

By Mr. Dorsey:

Q. 13. I notice the Yoshiki application refers to an alkali. That means an alkali metal oxide, does it not? A. An alkali metal oxide.

Q. 14. Now, you have said that the alkali metal oxides did not inhibit the formation of mullite. Is that true of the alkaline earth oxides also? A. Yes. It should be said, however, that the alkalis in this respect are much more powerful than the alkaline earths.

Q. 15. Now, you have given us an illustration which consisted of what happened when a batch which consisted of alumina and silica and an oxide of an alkali metal was cooled. Now please substitute an alkali earth, like magnesia, for the alkali metal oxide, and tell us what happens—so that your batch consists of magnesia, silica, and alumina. A. Just as before, the corundum crystals separate out first, resulting in an increase in silica in the liquid. The mullite then crystallizes. If the magnesia is below a certain percentage, the glass finally becomes so viscous that further crystallization can not proceed and a non-crystalline matrix is produced, which contains all of the magnesia and some of the silica and alumina.

Q. 16. Now, in what form is the magnesia found in this matrix, in what combination? A. Depending on the degree

of annealing, it comes close to the composition known as cordierite.

Q. 17. Can you tell us why Yoshiki says not to use more than one-tenth of one per cent magnesia in his batch? A. You mean alkali?

Q. 18. I beg your pardon. Of alkali. A. He is seeking to obtain a matrix which will have a low coefficient of thermal expansion; and he states that the ordinary matrix containing alkali has a higher coefficient of thermal expansion; and that a matrix of cordierite composition has a lower coefficient of thermal expansion.

Furthermore, in his number I batch, if he should use 7 per cent of magnesia, and also have alkali present, he would so inhibit the formation of mullite (as taught by Hauman) that he would not end with the combined
25 crystal make-up of corundum crystals plus mullite which he seeks.

Q. 19. Have you read and do you understand the Hauman patents? A. Yes.

Q. 20. Now, tell us what Mr. Hauman discloses in his patent 1,966,407. A. Well, Hauman's object is to take a batch which otherwise would yield more mullite than corundum, and obtain a greater yield of corundum, and to add to that what he terms a counterbalancing agent, which will increase the yield of corundum and decrease or eliminate the formation of mullite, with the end in view of separating this corundum for use as an abrasive. He further specifies that the corundum crystals shall be fully developed, as witness his use of the name euhedral in that connection.

Q. 21. Are you through? A. Yes.

Q. 22. What does he select as his counterbalancing agent?

The Court: As his what?

Mr. Dorsey: As his counterbalancing agent. A. In this patent he discusses the use of all of the alkali metal oxides and all of the alkaline earth metal oxides, or any combination thereof.

By the Court:

Q. 23. Doesn't he particularly suggest magnesia? A. Yes.

26 By Mr. Dorsey:

Q. 24. I call your attention to lines 139 to 145 on page 2 of this Hauman patent; and I will ask you if the proportions there given represent the percentages of the materials in the completed batch. A. No. He says specifically that the figures given are the "ratio of important ingredients." He also states, above, that his glass consists of "30% alumina, 50% silica, and 10% counterbalancing agent, the remainder being impurities."

If, as he illustrates, the silica constitutes 25% of the total composition, this would leave $2\frac{1}{2}$ per cent of impurities present. This actual total composition would then be calculated as 68.2 per cent alumina, 24.4 per cent silica, 4.9 per cent magnesia, and 2.5 per cent impurities.

Q. 25. Considering what Hauman starts with, as stated on line 135 et sequitur, page 2, "aluminous ore, such as Bauxite or diaspore, silica sand, and a counterbalancing agent, such as magnesia," what would be the impurities present in the normal working out of the invention?

A. Aluminous ores are dug from the ground and they naturally have associated with them various materials which are not wanted. The common contaminant of Bauxite, for example, is kaolin. Some kaolins have up to about 2.4 per cent of alkali oxides. The common contaminant of diaspore is fire clay. Analyses of Bauxite have been published which show a 3 per cent content of alkali; and diaspores often run that high in alkali. One of the important
27 impurities found in alminous ores would, therefore, be an alkali.

Q. 26. Can you give us any idea of what the percentage of alkali would be in the end product of Hauman? A. Without a very careful selection of his raw materials, he could not avoid adding at least one-tenth of one per cent alkali to his batch.

Q. 27. Do you find anything in the Hauman patent indicating that such careful selection has been made, should be made? A. No. He suggests the use of materials which are known as containing alkalies; and he specifically suggests the use of 5 per cent magnesia with 25 per cent silica. At the time Hauman filed, it was well known that 5 per cent magnesia was not sufficient to give the maximum corundum development and the minimum mullite development which he desired from the fusion.

Since Hauman further specifically mentions the use of alkali metal oxides in combination with the alkaline metal earth oxides, he certainly would not object to the presence of alkali in the raw material.

Q. 28. As one skilled in the art, if you were starting to carry out the Hauman patent and to obtain the end product described by Hauman, what would you use as your raw material, aluminous ores? A. Since it was well known that 5% of magnesia would not achieve the end that he desired, I would certainly see that the raw material used contained sufficient alkali, which, in combination with the 5 per cent of magnesia, would give a maximum corundum development and a minimum mullite development.

Q. 29. Will you now look at the other Hauman patent?

By the Court:

Q. 30. Before you leave this: Did you actually undertake to follow out this formula in actual practice, to see what the result would be of the combination he suggests? A. We have made melts containing both the alkaline earth oxides and the oxides of the alkali metals and we got the results of Hauman; and we have made melts with the alkali content reduced to one-tenth of one per cent and under and we got the results of Yoshiki.

Q. 31. Did you take Hauman's formula or just one of your own? A. Well, in using diaspore, we did not know what his diaspore was, but using the diaspore available to us we got his results. But when we used a mix with the alkali

content below one-tenth of one per cent we got Yoshiki's results.

Q. 32. He says "a typical mix contains 30% alumina, 50% silica, and 10% counterbalancing agent, the remainder being impurities." Does that have reference to the alkalies

there? A. Not completely. There can be anything in those ores. There can be iron oxide or titanium oxide in those ores, neither of which has a marked effect on the mullite development and neither of which he mentions as mullite suppressors.

Q. 33. What the impurities were would not make any difference? A. Yes, what the impurities were would make a tremendous difference; but iron oxide and titanium oxide, for instance, would be ineffective in reducing the formation of mullite.

By Mr. Dorsey:

Q. 34. Have you read the Hauman patent 1,966,406? A. Yes.

Q. 35. Is there anything in that patent which would lead you to select some different raw materials than you have testified to as the materials of the other Hauman patent?

A. No. That patent specifies the same aluminous ores, diaspor and Bauxite.

The Court: Why did Hauman get two patents, both issued at that time, July 10, 1934?

Mr. Reynolds: One was a continuation of the other.

The Court: What?

Mr. Reynolds: One was a continuation of the other. The second patent contained matter that was not in the first.

The Court: The first was which? 1,966,406?

Mr. Reynolds: 1,966,406; yes, sir.

Mr. Dorsey: The latter patent, as I understand, added some new matter and simplified the former.

Mr. Reynolds: Yes.

Mr. Dorsey: And you have treated them in that way. A. (continued) In line 92, page 1, of the Hauman patent 1,966,406, he suggests the use of 2½% of magnesia as a counterbalancing agent.

The Court: What line?

Mr. Dorsey: Line 92, page 1, of patent 1,966,406. A. (continued) And, since 5 per cent of magnesia was not sufficient without the help of the alkalies, why, obviously it would be necessary to use materials with more alkali to get Hauman's result—if he restricted himself to $2\frac{1}{2}$ per cent magnesia.

By Mr. Dorsey:

Q. 36. You have produced a sample of the product made according to the disclosure of the Yoshiki application? A. Yes.

Q. 37. Now, what were the materials used in mixing this batch from which you obtained that sample? A. The aluminous ore was selected, to introduce not over one-tenth of one per cent alkali. We used Bauxite.

Q. 38. You used Bauxite and silica and magnesia? A. Yes.

Q. 39. In the proportions specified? Is that right? A. Yes.

Q. 40. To give the proportions specified? A. To
31 give the final batch in those proportions.

By the Court:

Q. 41. What proportion of magnesia did you have there? A. That was 5 per cent magnesia.

Q. 42. He speaks of 8,000 pounds, that it needs 5 per cent, whereas the 1,000 pounds— A. (interposing) No. those are percentages—

Q. 43. (interposing) No. I am talking about this man Hauman. A. That is on a percentage basis. He is drawing the distinction there that a small furnace will cool faster than a large furnace.

The Court: All right.

By Mr. Dorsey:

Q. 44. Just what was the percentage of alkali in the Bauxite you used in this test? A. It was such that the 75% of Bauxite used contributed one-tenth of one per cent of alkali metal oxide to the composition.

By the Court:

Q. 45. You are referring to this specimen here, are you?

A. Yes, sir.

The Court: Let me understand now. Is that made according to the Japanese application?

Mr. Dorsey: This is a Yoshiki brick, made by Mr. Field.

By Mr. Dorsey:

32 Q. 46. You analyzed that Bauxite before you put it into that batch, didn't you, Mr. Field? A. Yes.

Q. 47. You had selected the proper Bauxite? A. Yes.

Even the best Bauxites contain usually more than one-tenth of one per cent alkali metal oxides; and we selected a particular Bauxite and obtained the maximum alkali permitted by Yoshiki; and we got by the skin of our teeth.

Q. 48. Did I hear you say something about getting by by the skin of your teeth? I would like to get that in the record. A. Correct.

Mr. Dorsey: That is all.

Cross Examination

By Mr. Reynolds:

XQ. 49. Is this product of the Yoshiki application made commercially? A. Not so far as I know, not in this country.

XQ. 50. Do you know why not? A. I would say primarily because the Corhart Refractories Company owns diaspore pits and is more interested in diaspore, which contains alkali, than in using Bauxite, which is critical.

33 XQ. 51. Now, you have referred to tests of the Hausman process. Did you make them personally? A. I calculated the batch and my men melted the material and I examined the product afterward.

XQ. 52. Now please explain just what ingredients you used in that test. A. I used diaspore, magnesia and fire clay.

XQ. 53. And what was the analysis of the diaspore? A. The diaspore used at that time would run about 1.7 per cent alkali.

XQ. 54. Is that a typical analysis? A. It has lately been increasing in both alkali and silica; the grade has been going down.

XQ. 55. But you could get some with one-tenth of one per cent alkali in it? A. Oh, no; never.

XQ. 56. What did you use when you carried out the Yoshiki process? A. I used the then commercial diasporite for the Hauman test. For the Yoshiki test I used Bauxite of a selected grade.

XQ. 57. Did you try Bauxite with the Hauman process? A. I have the—the Yoshiki and the Hauman processes would be—we used the same materials, but we did not get the Hauman result. You can call this batch a Hauman batch if you want to say that you used a high grade Bauxite, but it is not the Hauman result.

34 XQ. 58. I asked you if you tried Bauxite with the Hauman process. A. The process consists in melting—

XQ. 59. (interposing) Did you try that? A. That is what I did in producing the Yoshiki result—

XQ. 60 (interposing) I asked you if you tried it with the Hauman process?

The Court: Can you answer the question as he put it?

The Witness: What is the Hauman process?

By the Court:

XQ. 61. Did you make that test with the particular process of the Hauman patent? A. If I set out to produce the Hauman results, I would have to use a Bauxite with an alkali content similar to that in diasporite—

XQ. 62. (interposing) The question is: Did you make that test using Bauxite? A. We didn't have that type of Bauxite to use in our products.

XQ. 63. Therefore you did not do that? A. I did not use that.

XQ. 64. You did not use the test of this particular Hauman patent? Your test was not made according to that?

A. It was made according to that, to the extent that Hauman does not say what the alkali content of the Bauxite should be. I took Bauxite, which is all that Hauman
 35 teaches, and melted it with silica and magnesia, and I got the Hauman results. I took the materials Yoshiki teaches and melted them and I got the Yoshiki results.

XQ. 65. Then there is nothing new in Yoshiki? A. I got the Yoshiki results.

XQ. 66. You got the Yoshiki results? A. Yes, and only when I used the materials he specifies.

By Mr. Reynolds:

XQ. 67. Hauman suggests using Bauxite? A. Yes.

XQ. 68. And if you used commercial Bauxite in carrying it out, would you get Yoshiki's results? A. Not if you used the type of Bauxite we use.

XQ. 69. Suppose you used ordinary commercial Bauxite. A. That is the ordinary commercial Bauxite.

XQ. 70. How much alkali is in it? A. Usually two-tenths of one per cent.

XQ. 71. Didn't you say you used 3 per cent when you used the Hauman process? A. No; I said that Bauxites could have as much as 3 per cent alkali.

XQ. 72. If you did use two per cent or— A. (interposing) Two-tenths of one per cent.

XQ. 73. If you used Bauxite containing two-tenths of one per cent in the Hauman process what results would
 36 you get? A. You would get a glassy matrix, which would contain a considerably lower percentage of mullite, and the batch would have a higher coefficient of thermal expansion than if the matrix were cordierite.

XQ. 74. Would it have cordierite in it? A. Not according to Hauman's teaching. He says that he ends up with a—

XQ. 75. (interposing) I did not ask you that. I want the actual result. A. It would depend on how carefully and how slowly it was cooled down. As commercially made, it would not contain cordierite.

XQ. 76. When you use one-tenth of one per cent of alkali it does? A. The analysis then showed magnesia and not alkali—

XQ. 77. (interposing) The question was: Did it contain cordierite if you used one-tenth of one per cent of alkali? A. It gives a matrix which has an analysis similar to that given in the literature for cordierite.

XQ. 78. Well, is there a difference between two-tenths of one per cent and one-tenth of one per cent? A. You are approaching the quality of the two, certainly.

XQ. 79. Well, did you ever make a comparison of one-tenth and two-tenths of one per cent? A. You would have to measure the coefficient of thermal expansion to see
37 if there were any substantial difference. I have not done that.

XQ. 80. Two-tenths of one per cent is what you find in the ordinary commercial Bauxite? A. In the commercial grades that we used.

XQ. 81. Is that the ordinary commercial Bauxite? A. There are commercial Bauxites containing up to three per cent of alkali.

XQ. 82. Are they commonly used in glass making? A. I am not familiar with what they are used for in other than our product.

XQ. 83. You have used them? A. No. We selected our Bauxites to keep the alkali content down.

XQ. 84. Before you tried to keep the alkali content down, did you use Bauxite then? A. No.

XQ. 85. You never used it before? A. We used diasporite when the diasporite had sufficiently low alkali. Now we use a combination of Bauxite and diasporite to lower the alkali to what we need.

XQ. 86. But you never used Bauxite before you tried the Yoshiki process? Is that true? A. We have used Bauxite since 1932.

XQ. 87. What is the analysis of that Bauxite? A. We have always selected Bauxite on the basis of low
38 alkali and low silica.

XQ. 88. Don't you suppose every one else does the same thing? A. No. I don't see any reason why they should.

XQ. 89. Why did you? A. I said that we were trying to lower the alkali in our mix. The combination of the two would give us the alkali we used.

XQ. 90. Why did you wish to lower it? A. Because our blocks would crack unless we kept the alkali low.

XQ. 91. Doesn't every other maker have the same problem? A. No one else makes refractory blocks like ours.

XQ. 92. Is this application directed to refractory blocks? A. Yes.

XQ. 93. Are the claims drawn to them? A. Two of the claims are drawn toward the refractory product and one toward the method.

XQ. 94. I said refractory blocks. Are the claims drawn to the blocks? A. Nothing is said about the shape in which the refractory blocks is produced.

XQ. 95. Well, now, if you were to carry out the process of Hauman, using Bauxite having two-tenths of one per cent of alkali, you might get Yoshiki's results. Is that right? A. You would approach those as a limit.

XQ. 96. And that is a kind of Bauxite that is commercially available, is it not? A. It is a kind which is commercially available.

XQ. 97. Now, you have talked about Haumen's result. What do you understand to be his desired result? A. He specifically states that he wishes to get a preponderance of corundum in a composition which would otherwise have a predonderance of mullite.

XQ. 98. Does he say he eliminates mullite? A. He says he can.

XQ. 99. Doesn't he say it is necessary? A. He says he can use a product which contains up to 15 per cent of mullite, the mullite crystals being extremely small and embedded in the glass base.

XQ. 100. Now, does Yoshiki say how much mullite there is in his product? A. He says he wishes to produce a refractory similar to that made commercially.

XQ. 101. Where does he say that? A. Well, he starts out by saying that he wishes to produce a mullite-corundum refractory. He then goes on to say that he substitutes for the usual alkali glass base a matrix of cordierite. He refers to:

"The usual batch for electro-melting for casting refractories is a mixture of aluminous and siliceous substances containing 1% or over of alkali."

40 XQ. 102. You said that he says he wants to produce a block similar to that made commercially. Do you want to change that testimony? A. That is an inference, I will admit.

XQ. 103. Does he say anywhere how much mullite he has in his product? A. He does not.

XQ. 104. So, far as his teaching goes, it might be less than 15 per cent, might it not? A. I would say not.

XQ. 105. Why would you say that? A. The products obtained when pure alumina, silica, and magnesia are melted together have been very carefully worked out and the data published. It can be read from the map that nine per cent of magnesia rather than five per cent would be required to give the maximum corundum development and the minimum mullite development.

If you should take a composition of 75 parts alumina and 25 parts silica, melt it, and allow it to cool, in the absence of either alkali or alkaline earth, there would be obtained 94 per cent mullite and 6 per cent corundum. Hauman has used five-ninths as much magnesia as he should have used to change the composition from 94 per cent mullite down to 15 per cent mullite.

41 XQ. 106. Is that your answer to as to why Yoshiki gets more than 15 per cent mullite? A. I say that it would be impossible, with 5 per cent magnesia, in the absence of alkali, to get as low as 15 per cent

mullite. The product which I have exhibited here is very largely mullite and there is very little corundum in it.

XQ. 107. You never tried that, did you? A. Yes. The product is the result of that process.

XQ. 108. Of what process? A. Of the Yoshiki process, with 5 per cent magnesia and 25 per cent silica, in the absence of alkali.

XQ. 109. And how much mullite did you get? A. I would say over 50 per cent mullite.

XQ. 110. Now, you have mentioned a reference in the Hauman patent 1,996,407 to the impurities in the glass. What are considered impurities in the glass? A. Since the only crystals which have separated are pure alumina and pure aluminum silicate, obviously any other ingredients in the raw material must be present in that glass.

XQ. 111. Well now, he lists alumina, silica, and a counter-balancing agent; and everything else would be impurity, would it not? A. Yes.

XQ. 112. Well, then, wouldn't cordierite be an impurity? He says specifically that he ends up with "a glass." That leaves nothing else but cordierite, which is a crystal in character.

42 By the Court:

XQ. 113. Would you say it was not an impurity, in answer to his question? A. Yes.

By Mr. Reynolds:

XQ. 114. What would it be if it were not an impurity? A. I say that he stops at a position in cooling this refractory which leaves him two crystal phases and "a glass."

XQ. 115. And impurities? A. The impurities are in the glass.

XQ. 116. Suppose he had cordierite in there; wouldn't he list it as an impurity? A. Certainly not.

XQ. 117. What would he list it as? A. He would list it as a third crystal phase.

X-Q. 118. Does he list any crystal phases? A. Yes, corundum and mullite.

XQ. 119. Does he list any— A. (interposing) He is talking about the analysis of the glass which is left after the two crystal phases are formed.

XQ. 120. He says that it contains "30% alumina, 50% silica, and 10% counterbalancing agent, the remainder being impurities." Do you think if he had cordierite in there he would mention it by name? Do you? A. No. because cordierite is not part of the glass.

43 XQ. 121. Well, if it were in there, what else would it be? A. You are not calling corundum and mullite impurities, are you?

XQ. 122. It is mixed in with the glass? A. Also this corundum and the mullite, but they are crystals, and he is not discussing them.

XQ. 123. What do you think he means by impurities? A. He obviously refers to any impurities in his starting materials, in which he has diaspore and bauxite, and the impurities in those are iron and titanium oxides and alkali primarily.

XQ. 124. And if you had three-tenths of one per cent, say, of alkali in their, would that account for the ten per cent of impurities? A. No.

XQ. 125. So the impurities are largely something else than alkali? A. They may be.

X-Q. 126. So the fact that there is ten per cent of impurities is not any indication of the alkali content of the ore, is it? A. No.

Mr. Reynolds: That is all.

Redirect examination

By Mr. Dorsey:

44 ReDQ. 127. Bauxite is used for many purposes in the arts other than being melted into refractories, isn't it? A. Yes. A large bulk of it is used for other purposes.

ReDQ. 128. How is that? A. A large bulk of it is used for other purposes.

ReDQ. 129. And as to those is the alkali content of any great moment—in some of the others? A. No. The great bulk of Bauxite is used in making aluminum; and in that case the ore is fused with alkali; and obviously the alkali content would not be harmful there.

Mr. Dorsey: That is all.

Mr. Reynolds: That is all.

(The witness retired from the stand.)

Mr. Dorsey: Your Honor, I would like to offer in evidence this certified copy of the Yoshiki application.

The Court: Is that a copy of the file wrapper?

Mr. Dorsey: That is the file wrapper.

I think the copy you have in front of you gives the application to you in much more convenient form.

The Court: That will be plaintiff's Exhibit 1.

(Certified copy of file wrapper was received in evidence and marked as Plaintiff's Exhibit 1.)

Mr. Dorsey: I thank you for your courteous attention.

That is our only exhibit.

The Court: What about this specimen?

Mr. Dorsey: The specimen I will offer in evidence as Plaintiff's Exhibit 2.

45 (Specimen of product of the Yoshiki process was received in evidence and marked as Plaintiff's Exhibit 2.)

Mr. Reynolds: I would like to offer in evidence as Defendant's Exhibit 1 this folder, consisting of copies of:

A Hauman patent 1,966,406

B Hauman patent 1,966,407

C Statement of the Examiner

D Decision of the Board of Appeals.

(The document so produced and identified was received in evidence and marked as Defendant's Exhibit 1.)

The Court: Is that all?

Mr. Reynolds: That is all, your Honor.

The Court: Well, do you want to go out to lunch and then argue this with me?

Mr. Dorsey: Your Honor, I would like to have the record in front of me. It is a rather involved matter and I would like to file a little brief.

The Court: All right. I would like to have you do that.

Mr. Dorsey: As soon as I get the record I will get the brief to your Honor.

The Court: Then we will not have any argument and you will furnish me this testimony, with your brief?

Mr. Dorsey: Yes, your Honor.

(Thereupon the instant hearing was concluded and the Court adjourned until tomorrow.)

46

Memorandum.

This is an action under R. S. 4915 (35 U. S. C. § 63) in which the plaintiff seeks to have the Court authorize the allowance of certain claims to a refractory product and method of making it.

The specification of the Yoshiki application upon which the claims in issue are based reads as follows:

"The usual batch for electro-melting for casting refractories is a mixture of aluminous and siliceous substances containing 1% or over of alkali. As the melt cools, mullite and corundum crystallize out of the melt, with an increase of the alkali content in the still liquid phase which finally solidifies as a glass between the crystals. I find that by reducing the alkali content of the melt to 0.1% or under, and adding magnesia, the amount of glass is greatly reduced, and the space between the corundum and mullite crystals becomes filled with crystals of cordierite ($2MgO$, $2Al_2O_3$, $5SiO_2$) which act as a binder therefor.

"The following are example batch compositions which may be employed—

	I	II
Alumina	65%	70%
Silica	28	25
Magnesia	7	5

"The formation of crystals of coerdierite is aided by very slow cooling from the molten state.

"Cordierite is well known to have a very low expansion coefficient, therefore electrocast blocks containing appreciable percentages of cordierite are resistant to spalling."

The references relied on are two patents to Hauman, Nos. 1,966,406 and 1,966,407, the latter being a continuation in part of the former. The disclosures of these patents are quite similar and each suggests the production of a refractory article having as a "ratio of important ingredients," alumina (Al_2O_3) 70%, silica (SiO_2) 25% and magnesia (MgO) 5%. This is the identical proportioning given by Yoshiki. Neither Hauman nor Yoshiki suggests any new process of melting and cooling, and, therefore, it is assumed that both follow standard practice in this respect. Since both the application and the references use the same ingredients and their method of treatment is the same, it must follow that the end product in both cases must be the same. Clearly, one skilled in the art and following the teachings of Hauman will produce the results claims by Yoshiki.

The claims are unpatentable in view of Hauman and the complaint must be dismissed.

Counsel will please prepare and submit appropriate findings and conclusions, together with decree dismissing the complaint.

O. R. LUHRING,
Justice.

March 3, 1943.

• • • • •

48

Findings of Fact

1. This is an action under R. S. 4915 (U. S. C. title 35, section 63) in which it was sought to have the Court find that the plaintiff, Corning Glass Works, as assignee of the application of Yoshiki, No. 163,159, is entitled to have issued to it a patent containing claims 1 to 6, inclusive, of said application.

2. The Yoshiki application relates to a refractory product and method of making the same and states that if alumina, silica and magnesia are mixed in certain proportions and the alkali content is kept below 0.1% the batch, when melted, will produce a desirable product containing corundum, mullite and cordierite. The proportions of these ingredients in the final product are not disclosed. One example given of the contents of the initial batch, prior to melting, is 70% alumina, 25% silica and 5% magnesia.

3. The patents to Hauman, Nos. 1,966,406 and 1,966,407 disclose the production of refractory articles by the melting of a batch having as a "ratio of important ingredients" alumina 70%, silica 25% and magnesia 5%.

49 4. The ratio of ingredients set forth in the Hauman patents is identical with a ratio set forth by Yoshiki as being satisfactory for his purpose and the procedure followed in the Hauman patents is identical with that of the Yoshiki application.

5. Since both the application and the references use the same ingredients and their method of treatment is the same, it must follow that the end product in both cases must be the same.

6. One skilled in the art and following the teachings of Hauman will produce the results claimed by Yoshiki.

7. All the claims here involved are unpatentable in view of either of the Hauman patents.

Conclusions of Law

1. Plaintiff is not entitled to a patent containing any of claims 1 to 6, inclusive, of the Yoshiki application, No. 163,159.

2. The Complaint should be dismissed as to all the claims involved.

O. R. LUHRING,
Justice.

• • • • • • • • •

50

Judgment

This cause having come on to be heard and having been tried in open court and argued by counsel for the respective parties upon the pleadings and proofs adduced and submitted to the Court,

It is ADJUDGED this 15th day of March, 1943, that the complaint in this case be, and the same hereby is dismissed with costs against the plaintiff.

O. R. LUHRING,
Justice.

Approved as to form:

VERNON M. DORSEY,
Attorney for Plaintiff.

* * * * *

51

Notice of Appeal

Notice is hereby given this 8th day of April, 1943 that Corning Glass Works hereby appeals to the United States Court of Appeals for the District of Columbia from the judgment of this Court entered on the 15th day of March, 1943 in favor of Conway P. Coe, Commissioner of Patents, against said Corning Glass Works.

VERNON M. DORSEY,
Attorney for Appellant,
1346 F Street, N. W.,
Washington, D. C.

Copy to W. W. Cochran, Esq. Attorney for Appellee.

* * * * *

Memorandum

Corning Glass Works vs. Coe
Civil Action No. 13567

April 8, 1943

Cost bond on appeal (\$250.) filed.

* * * * *

52 *Statement of Points to be Relied on Appeal*

The appellant intends to rely on the following points in its appeal to the United States Court of Appeals for the District of Columbia in the above entitled cause:

1. The Court erred in dismissing the Complaint on the grounds and for the reasons stated in the conclusions of law appurtenant to the above entitled cause.

2. The Court erred in not granting the plaintiff the relief sought by the Complaint.

3. The Court erred in holding that the ratio of ingredients set forth in the Hauman patents is identical with a ratio set forth by Yoshiki as being satisfactory for his purpose.

4. The Court erred in assuming that the application and the references used the same ingredients.

53 5. The Court erred in holding that one skilled in the art and following the teachings of Hauman would produce the results claimed by Yoshiki.

6. The Court erred in holding that the claims of Yoshiki are unpatentable in view of either of the Hauman patents.

7. The Court erred in failing to find that the true teaching of the Hauman patents is to embody in the batch prior to melting a percentage of alkali greater than 0.1%.

8. The Court erred in failing to find that the product resulting from melting a batch containing less than 0.1% is different in kind and character from the product obtained by one following the Hauman teachings.

Respectfully,

CORNING GLASS WORKS

By VERNON M. DORSEY,

Attorney for Appellant

1346 F Street, N. W.,

Washington, D. C.

Dated: April 8th, 1943.

Copy to W. W. Cochran, Esq., Solicitor for Appellee.

• • • • • • • • •

54 *Order to Omit Duplication of Exhibits*

IT IS ORDERED THIS 4th day of May, 1943 with consent of the parties hereto, that plaintiff's original exhibits 1 and 2 and defendant's exhibit 1 to be used for the transcript of record to be certified to the United States Court of Appeals for the District of Columbia.

EDWARD C. EICHER
Chief Justice.

I consent:

VERNON M. DORSEY,
Attorney for Plaintiff.

W. W. COCHRAN,
Attorney for Defendant.

• • • • • • • • •

55 *Stipulation of Record*

It is hereby stipulated by and between counsel for the respective parties in this cause that the Clerk of the United States District Court for the District of Columbia prepare a transcript of record on appeal to the United States Court of Appeals for the District of Columbia in the above entitled cause to include the following:

1. Complaint.
2. Answer.
3. Statement of Evidence, transcript of testimony and proceedings, Plaintiff's Exhibits Nos. 1 and 2, Defendant's Exhibit No. 1.
4. Memorandum Opinion of Justice Luhring dated March 3, 1943.
5. Findings of fact and conclusions of law.
6. Final decree, dismissing the Complaint herein, notation of appeal and filing of bond for costs on appeal.
7. Statement by appellant of the points on which he intends to rely on the appeal.

8. Stipulation of the designation of the parts of the record, proceedings and evidence to be included in the record on appeal.

VERNON M. DORSEY,
Atty. for Plaintiff,
 1346 F Street, N. W.,
 Washington, D. C.

W. W. COCHRAN,
Atty. for Defendant,
 U. S. Patent Office,
 Washington, D. C.

April 23, 1943.

• • • • •

UNITED STATES PATENT OFFICE

1,966,406

EUHEDRAL CORUNDUM CRYSTAL

Earl Leeson Hauman, St. Catharines, Ontario, Canada, assignor to The Exolon Company, Blasdell, N. Y., a corporation of Massachusetts

No Drawing. Application October 8, 1928, Serial No. 311,262. Renewed December 5, 1933

13 Claims. (Cl. 75—22.5)

My present invention provides for the commercial production of alpha corundum either in separate or separable euhedral form of high crystal development or in dispersion in a glassy matrix.

The materials produced are of high abrasive or refractory values and the processes involved simple and definite so as to be capable of commercial working.

It has I believe been impossible to produce "alpha" corundum crystals of euhedral type or at least to do so commercially or if such were produced they were only rarely incidentally included in other products, as for example mixed in mullite. In fact, I would point out that it is the degenerative tendency toward mullite, in an aluminous melt containing considerable silica, which is in process of solidification, that has made it so difficult to obtain a preponderance of corundum in the solid mass.

In making ordinary corundum products it has heretofore been customary to hold down or eliminate the silica as low as possible to try to prevent as far as possible the development of mullite. Ordinarily, such products carry impurities such as metallic oxides and while crystalline do not show anything of euhedral type.

My invention contemplates a process by which I can produce corundum of high purity in a matrix, rich in silica and to the practical exclusion of mullite. By this process I can produce corundum crystals of alpha type and of euhedral form and can develop these to extended crystal growth. In fact, my process can be so worked as to give at one side a euhedral crystal dispersion in a glassy matrix well adapted for refractory purposes, and special abrasive uses, or on the other side extended and accumulated growths of such crystals separable from the matrix material and of high abrasive and refractory values.

As illustrative of the principles involved I will describe the practice of my invention in two characteristic cases of product each novel in itself but resultant from the underlying principles involved in my invention.

I may explain at the outset that I find that the use of a minimum of silica in the melt is not, as in the production of ordinary corundum, a prime determining factor. Under ordinary conditions too high silica in the melt promotes mullite formation which is detrimental to the structure. Under my invention this does not hold true. In fact, I find for my purposes that the presence of a considerable amount of silica

(say up to 25%) does no harm and is favorable to certain desiderata, notably that of crystal development and accretion.

In the practice of my invention I proceed as follows: A mixture of raw materials is prepared consisting of aluminous ore such as Bauxite or diaspore, silica sand, and an addition agent such as magnesia so proportioned as to give the following ration of important ingredients:

Al ₂ O ₃	70	65
SiO ₂	25	
MgO	5	

This mixture may be fused in an electric furnace of the steel shell arc type commonly used in the artificial abrasive industry. The ratio of power input to application of the mix is observed closely as means of governing the temperature of the melt. Thus, under any given rate of power input, a fast feed produces a relatively cool melt, whereas a retarded feed tends to produce a relatively hot bath. I have discovered that the temperature of the melt as the time of withdrawal of the power, determines the size and distribution of the corundum crystals. The cool melt produces small crystals uniformly spread through the matrix whereas the hot melt gives rise to the development of large crystals, in pocket formation in the mass.

After the shell has been charged to its capacity and the fusion is completed the electrodes are withdrawn and the cooling process allowed to proceed normally.

I have found that the addition of magnesia to the melt might be lowered with similar results in a furnace of small dimensions. For instance 2½% MgO in a mass of 1000 pounds is sufficient, whereas a melt approaching 8000 pounds needs 5% MgO for similar results, as to crystallization of the corundum.

The use of magnesia in relatively small amounts, as a component of the melt in which alumina and silica exist, roughly, 3 to 1, is to provide a balancing or reactive influence against those factors governing the rate of cooling existing in the process of solidifying a melt in the electric furnace. With magnesia present in small amount, say 5%, the temperature of formation of mullite falls off sharply, thereby increasing or extending the time for corundum crystal growth and at the same time decreasing the later period of time for mullite development. During this later reactive period wherein attack on the corundum crystal by the liquid normally occurs, the advantage of mass or size of the corundum crystal

is effective in retarding this destructive action. The steel shell, water cooled furnace is particularly adapted for the practice of my process because the cooling characteristics of the shell can be balanced by magnesia to the practical exclusion of mullite growth in the melt previously described. Such melt may be adjusted to present a molecular ratio of alumina to silica slightly in excess of 3 to 2, but in the practice of the invention it has been found necessary in attaining consistent results to vary this ratio within small limits depending upon quantity of melt being handled.

While I prefer magnesia as my addition agent because of its apparent superior efficiency other agents of flux like character such as lime may be used.

The difference in structure mentioned above as resulting from the cool or hot melts allows a choice of two products. The structure characterized by small, uniformly distributed crystals in the matrix is taken in this form as a product. On the other hand, the mass bearing segregations of large corundum crystals is broken down and subjected to electrostatic separation for accumulation of the corundum product. Although proportions may vary largely according to the particular characteristics wanted in the ultimate product the following analyses are typical of the products obtained by my method:—

	A	B	C
Glassy matrix.....	25	26.5	28
Euhedral corundum.....	75	68.5	62
Mullite.....	00	5	10
	100	100	100

Any of the foregoing products may be obtained from the same mix by varying the furnace size, or assuming that they are all to be fused in the same furnace, the several products could be obtained by varying either the alumina-silica ratio or the percentage of magnesia addition.

As a matter of fact the mullite might be present in even greater amount, say up to 15%, than the amount indicated in Table C and still give a product which is commercially useful. Similarly the ratio of glassy matrix to alpha corundum might be varied beyond the limits given in the foregoing tables. I have obtained commercially useful products in which the corundum limits were between 60% and 75% and the glassy matrix between 20% and 30%, the only requirement being that there shall be enough glassy matrix to promote the free growth of the corundum crystals to the substantial exclusion of the mullite, meaning thereby that the later period of mullite formation shall be either so shortened that the mullite will be present in relatively inconsiderable quantity, or entirely eliminated. Experience would indicate that anything under 20% of glassy matrix is an insufficient amount of glassy matrix to permit the free growth of the corundum crystal and I therefore set 20% as my lower limit for the glassy matrix.

As to the preponderance of corundum over mullite this depends upon the particular use to which the final product is to be put and in any event means a product in which the corundum crystals constitute more than half of the mass of corundum crystals, mullite and glassy matrix. Cross reference is made to my companion applications, Serial Numbers 599,599 and 593,600, both filed March 17, 1932.

What I therefore claim and desire to secure by Letters Patent is:

1. The process which consists in fusing a mixture of alumina and silica and magnesia in such proportions as to yield on solidification a preponderance of alpha corundum of euhedral crystalline characteristics in a glassy matrix, the proportions being approximately three parts alumina to one part silica with magnesia addition approximately 5% of the batch.

2. The process which consists in fusing a mixture of alumina and silica and magnesia in such proportions as to yield on solidification a preponderance of alpha corundum of euhedral crystalline characteristics in a glassy matrix with mullite in negligible amount, the proportions being approximately three parts alumina to one part silica with magnesia addition approximately 5% of the batch.

3. The process which consists in fusing a mixture of alumina and silica in the presence of an oxide of the group composed of calcium oxide and magnesium oxide and in such proportions as to yield on solidification a preponderance of alpha corundum of euhedral crystalline characteristics in a glassy matrix, the proportions being approximately three parts alumina to one part silica with alkaline earth oxide addition approximately 5% of the batch.

4. The furnace process in which alpha corundum crystals of euhedral type are produced, which consists in fusing a mixture of approximately 3 parts alumina to one part silica with accompanying reagent of approximately 5% of the batch of an oxide of the group composed of calcium oxide and magnesium oxide, in which said reagent is employed to counter balance the cooling characteristics of the furnace thereby extending the period of corundum crystal growth and shortening or eliminating the later period of mullite development.

5. The furnace method of promoting free crystallization of alpha corundum in a glassy matrix, which consists in fusing an alumina silica mixture which should give mullite and corundum with the mullite in preponderance with a balancing agent of an oxide of the group composed of calcium oxide and magnesium oxide in sufficient quantity to extend the period of corundum crystallization during cooling of the melt and to shorten or eliminate the later period of mullite development whereby to produce a preponderance of alpha corundum of euhedral characteristic with a considerably lesser amount of mullite in the glassy matrix.

6. The furnace method of promoting free crystallization of alpha corundum in a glassy matrix, which consists in fusing an alumina silica mixture which should give mullite and corundum with the mullite in preponderance with from approximately 2½% to 5% of a balancing agent of an oxide of the group composed of calcium oxide and magnesium oxide to extend the period of corundum crystallization during cooling of the melt and to shorten or eliminate the later period of mullite development whereby to produce a preponderance of alpha corundum of euhedral characteristic with a considerably lesser amount of mullite in the glassy matrix.

7. The furnace method of promoting free crystallization of alpha corundum in a glassy matrix, which consists in fusing an alumina silica mixture which should give mullite and corundum with the mullite in preponderance with magnesia in sufficient quantity to extend the period

BEST COPY AVAILABLE

from the original bound volume

of corundum crystallization during cooling of the melt and to shorten or eliminate the later period of mullite development whereby to produce a preponderance of alpha corundum of euhedral characteristic with a considerably lesser amount of mullite in the glassy matrix.

8. The furnace method of promoting free crystallization of alpha corundum in a glassy matrix, which consists in fusing an alumina silica mixture which should give mullite and corundum with the mullite in preponderance with from approximately 2½% to 5% of magnesia to extend the period of corundum crystallization during cooling of the melt and to shorten or eliminate the later period of mullite development whereby to produce a preponderance of alpha corundum of euhedral characteristic with a considerably lesser amount of mullite in the glassy matrix.

9. Alpha corundum crystals of euhedral characteristic derived from a furnace melt of alumina and silica which should give mullite and corundum with a preponderance of mullite but which melt when altered by the addition of a balancing agent of an oxide of the group composed of calcium oxide and magnesium oxide in sufficient quantity yields on solidification a glassy matrix in sufficient amount to counterbalance the cooling characteristic of the furnace and to provide for the free growth of the corundum crystals in the matrix by extending the period of corundum growth and shortening or eliminating the later period of mullite development, said corundum crystals being characterized by high purity of composition, platy form, and freely developed structure, and by being present in the glassy matrix in predominating amount in respect to the mullite.

10. As a new composition of matter, a fusion product resulting from the fusion and cooling of an alumina silica mix which should give mullite in preponderance to corundum but which when

modified by the addition of from 2½% to 5% of an oxide of the group composed of calcium oxide and magnesium oxide to counterbalance the cooling characteristic of the furnace and thereby extend the period of corundum crystal growth and shorten or eliminate the later period of mullite development, forms a mass consisting of a glassy matrix containing alpha corundum crystals of relatively large freely developed type, the alpha corundum crystals constituting a preponderance of the mass, and the glassy matrix being present in sufficient amount to have caused the free growth of the corundum crystals with little or no mullite formation.

11. As a new composition of matter, a mass consisting of a glassy matrix containing alpha corundum crystals of relatively large freely developed type, the alpha corundum crystals constituting a preponderance of the mass, and the glassy matrix being present in sufficient amount to have caused the free growth of the corundum crystals and containing a small amount of an oxide of the group composed of calcium oxide and magnesium oxide.

12. As a new composition of matter resulting from the fusion and cooling of a mix of alumina and silica which should give mullite in preponderance to corundum, but which when modified by the addition of a small amount of an oxide of the group composed of calcium oxide and magnesium oxide forms a mass consisting of a glassy matrix containing alpha corundum crystals of relatively large freely developed type, the alpha corundum crystals constituting a preponderance of the mass, and the glassy matrix being present in sufficient amount to have caused the free growth of the corundum crystals with little or no mullite formation.

13. A composition of matter as claimed in claim 12 wherein the oxide is a magnesium oxide.

EARL LEESON HAUMAN.

BEST COPY AVAILABLE

from the original bound volume

UNITED STATES PATENT OFFICE

1,966,407

CORUNDUM PRODUCT AND PROCESS OF PRODUCING THE SAME

Earl Leeson Hauman, St. Catharines, Ontario, Canada, assignor to The Exolon Company, Blasdel, N. Y., a corporation of Massachusetts

No Drawing. Application March 17, 1932,
Serial No. 599,599

11 Claims. (Cl. 75—22.5)

This invention relates to electric furnace products and particularly to an aluminous oxide product resulting from the fusion and cooling of an alumina silica mix which should give mullite in preponderance to corundum but which when modified by the addition of a counterbalancing or absorption preventing agent which counterbalances the cooling characteristic of the furnace, thus extending the period of corundum crystal growth and shortening or eliminating entirely the later period of mullite development, forms a product of entirely new characteristics. Such product consists of a glassy matrix containing alpha corundum crystals of such relatively large and freely developed type as to constitute an entirely new variety of alpha corundum and for which I have coined the name "euhedral" corundum. These crystals constitute a preponderance of the mass and were developed in a glassy matrix of sufficient amount to have caused their free growth with little or no mullite formation.

My present invention is a continuation in part of my prior application Serial No. 311,262, filed October 8, 1928, to which reference is made as containing a general disclosure of my novel product and the method of producing the same.

The presence of incidental corundum in a normally mullite yielding alumina silica mix has been observed by workers in the art, but such incidental corundum existed in relatively insignificant amount and solely as an impurity in the mullite or sillimanite. These incidental corundum crystals were microscopic in size and of no commercial value. As shown in Fig. 8 of the article by Sims, Fisher & Wilson at p. 521 of their article in vol. XLVI of the Transactions of the American Electro Chemical Society for 1924.

In obtaining these incidental corundum crystals an excess of alumina was used in the melt than was necessary to develop mullite so that on solidification not all of the alumina was combined with the silica, forming a satisfied silicate (mullite) but instead a residue of alumina remained which crystallized out as corundum.

Sims, Wilson and Fisher at p. 525 of said article explained this phenomenon by stating that "Starting with molten material with a composition slightly greater in silica than the 3:2 ratio and allowing it to cool we find that at 1900° C. corundum starts to crystallize out, and continues until 1810° C. is reached. At this point sillimanite (mullite) ($3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$) needles start to form and the small corundum crystals are reabsorbed by the liquid. The sillimanite crystals continue to grow uninterrupted in a liquid medium through the comparatively long range of 265° C., or until the sillimanite-silica eutectic at 1545° C. is reached.

My discovery however was that starting with a molten mix of alumina and silica which nor-

mally would form mullite with little or no corundum, as shown by said Sims, Wilson & Fisher article, I can prevent the reabsorption of the corundum crystals by the liquid as the melt cools, thus giving me a preponderance of corundum in freely developed form with little or no mullite, the corundum although crystallizing out at 1900° C. and continuing through a temperature range of about 435° C., is not reabsorbed by the liquid at 1810° C. Such mullite as may be formed in my novel product is entirely incidental and exists solely as an impurity in the mass.

I prevent such mullite formation while at the same time permitting the free growth of the corundum crystals by the use of a counterbalancing or absorption-preventing agent which I add to the normal mullite yielding alumina-silica mix before or during the fusion of the mix. Such agent may be any of the alkaline earth oxides, as the oxides of beryllium, magnesium, calcium, barium, and strontium, or it may be any of the oxides of the alkali metals such as potassium, sodium, lithium, rubidium, and cesium, or any combination of these two oxide groups.

The selection of the balancing agent depends upon the characteristics wanted in the ultimate glass. If a glass of high melting point is wanted, one or more members of the alkaline earth group will be used. If a glass of low melting point is wanted, one or more members of the alkali group will be used. If a glass having a melting point between these high and low melting points is wanted, one or more members of the alkaline earth oxide group may be combined with one or more members of the alkali group.

In any event, it is of the utmost importance that the counterbalancing agent used shall prevent the absorption of the alumina, forming the aluminum silicate, and that the residual glassy matrix shall exist in sufficient amount to have provided for the free growth of the corundum crystals to the practical exclusion of the mullite.

In other words, the balancing agent so modifies the solidifying action of the matrix-forming constituents of the melt, chiefly the silica, as to prevent or forestall any material absorption of the corundum crystals by the silica into the undesired mullite crystals as the melt cools. This counterbalancing agent is employed under such controlled conditions of power input, rate of cooling and adjustment of the quantity of the counterbalancing agent to the size of the melt as is necessary to prevent reabsorption of the corundum and undesired mullite growth.

In thus providing a balancing or reactive influence against the cooling effects existing in the process of solidifying such a normally mullite yielding alumina silica melt in the electric furnace, I necessarily have to adjust the quantity of the balancing agent to the several varying fac-

BEST COPY AVAILABLE

from the original bound volume

UNITED STATES PATENT OFFICE

1,966,407

CORUNDUM PRODUCT AND PROCESS OF
PRODUCING THE SAMEEarl Leeson Hauman, St. Catharines, Ontario,
Canada, assignor to The Exolon Company,
Blasdell, N. Y., a corporation of MassachusettsNo Drawing. Application March 17, 1932,
Serial No. 599,599

11 Claims. (Cl. 75-22.5)

This invention relates to electric furnace products and particularly to an aluminous oxide product resulting from the fusion and cooling of an alumina silica mix which should give mullite in preponderance to corundum but which when modified by the addition of a counterbalancing or absorption preventing agent which counterbalances the cooling characteristic of the furnace, thus extending the period of corundum crystal growth and shortening or eliminating entirely the later period of mullite development, forms a product of entirely new characteristics. Such product consists of a glassy matrix containing alpha corundum crystals of such relatively large and freely developed type as to constitute an entirely new variety of alpha corundum and for which I have coined the name "euhedral" corundum. These crystals constitute a preponderance of the mass and were developed in a glassy matrix of sufficient amount to have caused their free growth with little or no mullite formation.

My present invention is a continuation in part of my prior application Serial No. 311,262, filed October 8, 1928, to which reference is made as containing a general disclosure of my novel product and the method of producing the same.

The presence of incidental corundum in a normally mullite yielding alumina silica mix has been observed by workers in the art, but such incidental corundum existed in relatively insignificant amount and solely as an impurity in the mullite or sillimanite. These incidental corundum crystals were microscopic in size and of no commercial value. As shown in Fig. 8 of the article by Sims, Fisher & Wilson at p. 521 of their article in vol. XLVI of the Transactions of the American Electro Chemical Society for 1924.

In obtaining these incidental corundum crystals an excess of alumina was used in the melt than was necessary to develop mullite so that on solidification not all of the alumina was combined with the silica, forming a satisfied silicate (mullite) but instead a residue of alumina remained which crystallized out as corundum.

Sims, Wilson and Fisher at p. 525 of said article explained this phenomenon by stating that "Starting with molten material with a composition slightly greater in silica than the 3:2 ratio and allowing it to cool we find that at 1900° C. corundum starts to crystallize out, and continues until 1810° C. is reached. At this point sillimanite (mullite) ($3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$) needles start to form and the small corundum crystals are reabsorbed by the liquid. The sillimanite crystals continue to grow uninterrupted in a liquid medium through the comparatively long range of 265° C., or until the sillimanite-silica eutectic at 1545° C. is reached.

My discovery however was that starting with a molten mix of alumina and silica which nor-

mally would form mullite with little or no corundum, as shown by said Sims, Wilson & Fisher article, I can prevent the reabsorption of the corundum crystals by the liquid as the melt cools, thus giving me a preponderance of corundum in freely developed form with little or no mullite, the corundum although crystallizing out at 1900° C. and continuing through a temperature range of about 435° C., is not reabsorbed by the liquid at 1810° C. Such mullite as may be formed in my novel product is entirely incidental and exists solely as an impurity in the mass.

I prevent such mullite formation while at the same time permitting the free growth of the corundum crystals by the use of a counterbalancing or absorption-preventing agent which I add to the normal mullite yielding alumina-silica mix before or during the fusion of the mix. Such agent may be any of the alkaline earth oxides, as the oxides of beryllium, magnesium, calcium, barium, and strontium, or it may be any of the oxides of the alkali metals such as potassium, sodium, lithium, rubidium, and cesium, or any combination of these two oxide groups.

The selection of the balancing agent depends upon the characteristics wanted in the ultimate glass. If a glass of high melting point is wanted, one or more members of the alkaline earth group will be used. If a glass of low melting point is wanted, one or more members of the alkali group will be used. If a glass having a melting point between these high and low melting points is wanted, one or more members of the alkaline earth oxide group may be combined with one or more members of the alkali group.

In any event, it is of the utmost importance that the counterbalancing agent used shall prevent the absorption of the alumina, forming the aluminum silicate, and that the residual glassy matrix shall exist in sufficient amount to have provided for the free growth of the corundum crystals to the practical exclusion of the mullite.

In other words, the balancing agent so modifies the solidifying action of the matrix-forming constituents of the melt, chiefly the silica, as to prevent or forestall any material absorption of the corundum crystals by the silica into the undesired mullite crystals as the melt cools. This counterbalancing agent is employed under such controlled conditions of power input, rate of cooling and adjustment of the quantity of the counterbalancing agent to the size of the melt as is necessary to prevent reabsorption of the corundum and undesired mullite growth.

In thus providing a balancing or reactive influence against the cooling effects existing in the process of solidifying such a normally mullite yielding alumina silica melt in the electric furnace, I necessarily have to adjust the quantity of the balancing agent to the several varying fac-

BEST COPY AVAILABLE

from the original bound volume

tors which may be present for any particular run. These factors may include the size or capacity of the furnace, the radiation from the top of the furnace and the transference of heat through the insulation and side walls, and also through the furnace bottom. Inasmuch as solidification takes place from the walls inward, the greater the mass the greater the time for crystal growth and solidification of the mass, the effect being the same as additional insulation with a smaller mass.

In any event, the resultant fusion product is a mass consisting of a glassy matrix and alpha corundum crystals of relatively large freely developed type, the alpha corundum crystals constituting a preponderance of the mass and the glassy matrix being present in sufficient amount to have caused the free growth of such corundum crystals, with little or no mullite formation. Such mass is capable of crushing to granular form to provide on the one hand a separation product which is high in glassy matrix and low in alumina crystals, containing in fact a higher glass content than the original mass, and on the other hand a crushed separation product which is high in alumina crystals and low in glassy matrix, such product containing in fact a higher crystalline alumina content than the original mass. As a still further separation product, I may have a product containing approximately equal parts of crystalline alumina and glass. As explained in my said prior application Ser. No. 311,262, such separation may be effected electrostatically or by any other well known means of classifying.

Petrographic analysis shows that the mass is a ground mass in which are embedded well developed transparent crystals showing no definite orientation. These crystals are optically identified with the irregular corundum grain familiar in the art, the striking difference being that they are well crystallized, or euhedral in form. These crystals are platy or tabular in habit, being elongated parallel to the basal direction, and frequently show hexagonal outlines. These platy crystals are truncated with rhombohedral faces, and in thin section may show a trapezoidal cross section. They present optical properties checking exactly with those of alpha corundum, namely, they give a uni-axial interference figure, the optical character is negative, and the index of refraction is above 1.74. The surface of these crystals is uncorroded, showing no evidence of attack by the glass while in the molten state.

The ground mass, or interstitial material in which the crystals occur, consists of a smooth dull black substance resembling flint or chert in appearance. It consists of an unstable glass, filled with microscopic inclusions. It is identified optically as a glass because it is isotropic, that is although transmitting ordinary light, between crossed nicols it is absolutely opaque, which shows that its optical properties are the same in all directions.

The greater part of the inclusions in this unstable glass consist of microscopic needle-like crystals, identified as mullite.

The glass, together with the inclusions, has a composition high in alumina and silica, and is in striking contrast to the slags or clear siliceous glassy matrices familiar in the art of preparing crystalline corundum of the ordinary type, or in producing artificial mullite with its accompanying siliceous glass and incidental corundum,

Mullite crystals of a prismatic type are occasionally embedded between the plates of the corundum crystals in a thin layer of glass, but constitute an insignificant part of the whole. Such glass is an unstable glass consisting of the residual alumina, silica, and alkali or alkaline earth oxide used as the balancing agent, together with such metallic oxide impurities as may have been present in the original mix.

In a typical mix, such glass contains approximately 30% alumina, 50% silica, and 10% counterbalancing agent, the remainder being impurities.

When fired at ordinary bonding temperatures this unstable glass becomes stable and a profusion of larger needle-like mullite crystals are developed around the original mullite inclusions as nuclei. These mullite crystals give to the glass a remarkable mechanical and refractory strength. The glass thus becomes an excellent bond under kiln conditions common in the ceramic industry which bond as well as the crystal itself has the property of burning to a snow white color under oxidizing conditions so that when a mass of the crystals and matrix is ground to fine sizes a material is obtained which has the valuable property of being self-bonding in action. This gives a structure embodying both the abrasive and wear resisting properties of the fused aluminum oxide crystal in a ground mass of its original matrix and such a structure is exceptionally well adapted in the field of abrasive or wear resisting articles due to the simplicity of formation, the self-bonding action, the abrasive and wear resisting properties of the crystal and the presentation of any impurities in an easily oxidizable form, producing a substantially snow white article which is therefore subject to a wide variety of color applications well known in the ceramic field. The platy euhedral form of the crystal, moreover, is advantageous in that it enhances the structural strength of the article into which it is fabricated as well as possessing that important and recognized essential property in an abrasive article of constantly presenting new cutting edges by minute fracture in the process of wear or use.

My process can be so worked as to give at one side an euhedral crystal dispersion in a glassy matrix well adapted for refractory purposes, and special abrasive uses, or on the other side extended and accumulated growths of such crystals separable from the matrix material and of high abrasive and refractory values.

As illustrative of the principles involved I will describe the practice of my invention in two characteristic cases of product, each novel in itself, but resultant from the underlying principles involved in my invention.

In the practice of my invention I proceed as follows: A mixture of raw materials is prepared consisting of aluminous ore, such as Bauxite or diaspore, silica sand, and a counterbalancing or absorption preventing agent, such as magnesia, so proportioned as to give the following ratio of important ingredients:

Al ₂ O ₃	70
SiO ₂	25
MgO.....	5

This mixture may be fused in an electric furnace of the steel shell arc type commonly used in the artificial abrasive industry. The ratio of power input to application of the mix is observed closely as a means of governing the temperature

of the melt. Thus, under any given rate of power input, a fast feed produces a relatively cool melt, whereas a retarded feed tends to produce a relatively hot bath. The temperature of the melt at the time of withdrawal of the power, is a factor in determining the size and distribution of the corundum crystals. The cool melt produces small crystals uniformly spread through the matrix whereas the hot melt gives rise to the development of large crystals, in pocket formation in the mass.

After the shell has been charged to its capacity and the fusion is completed the electrodes are withdrawn and the cooling process allowed to proceed normally.

I have found that the addition of the alkali and/or alkaline earth oxide to the melt might be lowered with similar results in a furnace of small dimensions. For instance 2½% counterbalancing agent in a mass of 1000 pounds is sufficient, whereas a melt approaching 8000 pounds needs 5% counterbalancing agent for similar results, as to crystallization of the corundum.

Although proportions may vary largely according to the particular characteristics wanted in the ultimate product the following analyses are typical of the products obtained by my methods:

	A	B	C
Glassy matrix.....	25	26.5	28
Euhedral corundum.....	75	68.5	62
Mullite.....	00	5	10

Any of the foregoing products may be obtained from the same mix by varying the furnace size, or assuming that they are all to be fused in the same furnace, the several products could be obtained by varying either the alumina-silica ratio or the percentage of magnesia addition. By adjusting the factors mentioned I have been able to form the euhedral corundum of varying mixes as low in alumina to silica ratio as 60 to 40 and as high as 86 to 14.

As a matter of fact, the mullite might be present in even greater amount, say up to 15%, than the amount indicated in Table C and still give a product which is commercially useful. Similarly, the ratio of glassy matrix to alpha corundum might be varied beyond the limits given in the foregoing tables. I have obtained commercially useful products in which the corundum limits were between 60% and 75% and the glassy matrix between 20% and 30%, the only requirement being that there shall be enough glassy matrix to promote the free growth of the corundum crystals to the substantial exclusion of the mullite, meaning thereby that the later period of mullite formation shall be either so shortened that the mullite will be present in relatively inconsiderable quantity, or entirely eliminated. Experience would indicate that anything under 20% of glassy matrix is an insufficient amount of glassy matrix to permit the free growth of the corundum crystal and I therefore set 20% as my lower limit for the glassy matrix.

As to the preponderance of corundum over mullite, this depends upon the particular use to which the final product is to be put and in any event means a product in which the corundum crystals constitute more than half of the mass of corundum crystals, mullite and glassy matrix.

Similarly, the ratio of alumina and silica is only approximate, the precise alumina silica ratio being really determined by the size of the

furnace and the amount of magnesia or other counterbalancing agent added to the mix to counterbalance the cooling characteristics of the peculiar size of furnace employed, it being sufficient only that such ratio be a ratio which will produce corundum. Expressed differently, the alumina silica ratio is a ratio which, but for the addition of the furnace balancing agent of magnesia or the like, would produce mullite and corundum with a preponderance of mullite, but which because of the addition of such furnace balancing agent in an amount sufficient to produce a glassy matrix of sufficient size to extend the period of corundum crystal growth during cooling of the mullite and to shorten or eliminate the later period of mullite development produces alpha euhedral corundum to the practical exclusion of mullite. Cross reference is made to my concurrently filed application, Ser. No. 599,600.

What I therefore claim and desire to secure by Letters Patent is:—

1. As a new composition of matter, a mass consisting of a glassy matrix containing a preponderance of alpha corundum crystals without mullite in appreciable quantity, said mass resulting from the fusion and cooling of a mix consisting of from 60 to 86 parts of alumina to from 40 to 14 parts of silica together with an oxide of the group composed of alkaline earth and alkali metal oxides in sufficient amount to extend the period of corundum crystallization during cooling of the melt and to shorten or eliminate the later period of mullite development, the corundum crystals being relatively large as to size, platy as to form, and being well defined and freely developed as to structure, and the glassy matrix being present in sufficient amount to have provided for such free growth of the crystals and being an unstable glass rich in alumina and having the property of forming mullite and a stable clear glass on heating to ordinary bonding temperatures.

2. A new composition of matter as claimed in claim 1, wherein the mass contains approximately from 60 to 75% of the alpha corundum crystals.

3. A new composition of matter as claimed in claim 1, wherein the glassy matrix constitutes at least 20% of the mass.

4. A new composition of matter as claimed in claim 1, wherein the mass contains approximately from 60 to 75% of the alpha corundum crystals and said glassy matrix constitutes at least 20% of the mass.

5. A new composition of matter as claimed in claim 1, wherein the balancing agent is an oxide of an alkali metal.

6. As a new composition of matter, a mass consisting of a glassy matrix containing a preponderance of alpha corundum crystals without mullite in appreciable quantity, said mass resulting from the fusion and cooling of a mix consisting of from 60 to 86 parts of alumina to from 40 to 14 parts of silica together with an oxide of the group composed of alkaline earth and alkali metal oxides in sufficient amount to extend the period of corundum crystallization during cooling of the melt and to shorten or eliminate the later period of mullite development, the corundum crystals being relatively large as to size, platy as to form, and being well defined and freely developed as to structure, the glassy matrix being present in sufficient amount to have provided for such free growth of the crystals, and said glassy matrix resembling flint or chert in appearance and being optically identified as an unstable glass and con-

45
taining extremely small needle-like crystals of mullite, said glass and mullite inclusions being high in alumina and having the property of forming a stable clear glass on heating to ordinary bonding temperatures.

5 7. As a new composition of matter, a mass consisting of a glassy matrix containing a preponderance of relatively large, well defined and freely developed alpha corundum crystals without mullite in appreciable quantity, said mass resulting from the fusion and cooling of a mix consisting of from 60 to 86 parts of alumina to from 40 to 14 parts of silica together with an oxide of the group composed of alkaline earth and alkali metal oxides
10 in sufficient amount to extend the period of corundum crystallization during cooling of the melt and to shorten or eliminate the later period of mullite development, the corundum crystals constituting from 60% to 75% of the mass and the
15 glassy matrix constituting approximately 20% of the mass and being an unstable glass rich in alumina and having the property of forming mullite and a stable clear glass on heating to ordinary bonding temperatures.

20 8. As a new separation product resulting from crushing and separating the composition of matter claimed in claim 7, a ground mass of crystals and glass having a higher crystalline alumina content than the original composition of matter.

9. As a new separation product resulting from crushing and separating the composition of matter claimed in claim 7, a ground mass of crystals and glass having a higher glass content than the original composition of matter.

10. The furnace method of promoting free crystallization of alpha corundum in a glassy matrix, which consists in fusing an alumina silica mixture consisting of from 60 to 86 parts of alumina to from 40 to 14 parts of silica together with an absorption prevention oxide of the group composed of alkaline earth and alkali metal oxides, in sufficient amount to extend the period of corundum crystallization during cooling of the melt and to shorten or eliminate the later period of mullite development whereby to produce a mass consisting of a preponderance of relatively large, well defined and freely developed alpha corundum crystals and a minor dispersion of mullite in a glassy matrix of sufficient amount to have provided for such corundum development, said glassy matrix consisting of the residual alumina, silica and balancing oxide and having the property of forming mullite and a stable clear glass on heating to ordinary bonding temperatures.

11. The furnace method as claimed in claim 10, wherein the absorption prevention agent is an oxide of an alkali metal.

EARL LEESON HAUMAN.

80

85

90

95

100

105

110

115

120

125

130

135

140

145

150

To All Whom It May Concern:

Be it known that I, Bunpei Yoshiki, a subject of the Emperor of Japan, and a resident of Tokio, Japan, have invented new and useful improvements in "Mullitic Cast Refractories Having an Extremely Low Coefficient of Thermal Expansion" of which the following is a specification.

The object of this invention is to produce a mullite-corundum refractory having high resistance to spalling. This I do by substituting cordierite for the glassy matrix usually present between the mullite and corundum crystals, by using a batch containing magnesia and only a minimum amount of alkali.

The usual batch for electro-melting for casting refractories is a mixture of aluminous and siliceous substances containing 1% or over of alkali. As the melt cools, mullite and corundum crystallize out of the melt, with an increase of the alkali content in the still liquid phase which finally solidifies as a glass between the crystals. I find that by reducing the alkali content of the melt to 0.1% or under, and adding magnesia, the amount of glass is greatly reduced, and the space between the corundum and mullite crystals becomes filled with crystals of cordierite ($2MgO, 2Al_2O_3, 5SiO_2$) which act as a binder therefor.

The following are example batch compositions which may be employed—

The following are example batch compositions which may be employed—

	I	II
Alumina	65%	70%
Silica	28	25
Magnesia	7	5

60 The formation of crystals of cordierite is aided by very slow cooling from the molten state.

Cordierite is well known to have a very low expansion coefficient, therefore electrocast blocks containing appreciable percentages of cordierite are resistant to spalling.

61 What I claim is:

1. The hereinbefore described method of producing a body containing mullite, corundum and cordierite which comprises melting a batch containing alumina, silica, and magnesia and being substantially free from alkali.

2. The hereinbefore described refractory product consisting of mullite and corundum crystals with a cordierite matrix.

3. The hereinbefore described refractory product consisting of mullite and corundum crystals bonded with cordierite.

BUNPEI YOSHIKI

* * * * *

78 Add the following claims:

4. The hereinbefore described method of producing a body containing mullite, corundum and cordierite and analysing less than 0.1% alkali which comprises melting a batch containing alumina, silica, and magnesia.

5. The hereinbefore described refractory product consisting of substantial quantities of mullite and corundum crystals with a matrix substantially cordierite.

6. The hereinbefore described refractory product consisting of substantial quantities of mullite and corundum crystals with a bond substantially cordierite.

* * * * *

Examiners Statement

81 This is an appeal from the final rejection of claims 1 to 3. Claims 4 to 6 have been added for purposes of appeal after the final rejection. These are the only claims now in the application. The appealed claims are:

1. The hereinbefore described method of producing a body containing mullite, corundum and cordierite which comprises melting a batch containing alumina, silica, and magnesia and being substantially free from alkali.

2. The hereinbefore described refractory product consisting of mullite and corundum crystals with a cordierite matrix.

3. The hereinbefore described refractory product consisting of mullite and corundum crystals bonded with cordierite.

4. The hereinbefore described method of producing a body containing mullite, corundum and cordierite and analysing less than 0.1% alkali which comprises melting a batch containing alumina, silica, and magnesia.

5. The hereinbefore described refractory product consisting of substantial quantities of mullite and corundum crystals with a matrix substantially cordierite.

82 6. The hereinbefore described refractory product consisting of substantial quantities of mullite and corundum crystals with a bond substantially cordierite.

The references are:

Hauman	1,966,406	July 10, 1934
Hauman	1,966,407	July 10, 1934

This application concerns a refractory made by fusing a batch of the following composition:

Alumina	70%
Silica	25%
Magnesia	5%

Applicant states that the final product consists of mullite, corundum and cordierite.

Both of the references disclose fusing of a batch which has the identical composition of applicant's batch above set forth. See patent 1,966,406, page 1, lines 65 to 68 or patent 1,966,407, page 2, lines 141-144. The references do not state that the final product will contain cordierite but the references do state that the final product will contain mullite and corundum.

It is the Examiner's position that both the application and references use exactly the same starting ingredients as shown by the patch analysis above and that furthermore

the method of treating these starting ingredients is the same both in the references and the application, that is, the treatment consists of fusing the materials. It therefore follows that the final product in both cases must be the same, since it is impossible to treat the same materials in the same manner and secure different products.

83 Applicant argues in the first place that since the references do not state that cordierite is present in the final product there is no reason to assume that it will be present. This is a fallacious argument, since the mere failure to state the presence of this constituent does not mean that it is not present and applicant has not attempted at any stage of the prosecution to prove his point by making a product according to the teaching of the patents and showing that it will be free from cordierite. This being the case, any conclusion that cordierite is absent is unwarranted.

Applicant argues in the second place that he describes the presence of cordierite which will serve as a bond for the other ingredients, whereas the patents disclose that the bond will be a glassy matrix. However, it appears quite clear that applicant will have some glassy matrix present in his own product, since there is a high silica content and furthermore applicant has nowhere attempted to prove during the prosecution that there will be a complete absence of any glassy matrix from his own product. It is therefore only fair to presume that in both cases, that is, in both the application and the patents, there will be some cordierite and some glassy matrix present.

In the third place applicant argues that he uses less than 0.1% alkali in his product and that it is this retaining of the alkali content to such a low amount that distinguishes from the patents. However, it is nowhere shown by applicant that there is necessarily more than 0.1% of alkali present in the composition of the patents and
84 applicant is indulging in wishful thinking when he asserts that there will necessarily be such a high content of alkali content. As a matter of fact, the analysis shown in

both the patents fails to show the presence of any alkali and such small amounts as may be present due to impurities may well be below the content of 0.1% specified by applicant.

All of the claims are therefore anticipated by the references for the reasons above discussed.

Respectfully submitted,

C. F. KRAFFT

Examiner, Division 38

Attorneys:

DORSEY, COLE & GARNER

1346 F St., N. W.

Washington, D. C.

91 Endorsed: U. S. Patent Office Board of Appeals
Mailed May 10 1941

Paper No. 16

Appeal No. 35,279

OB

In the United States Patent Office

Before the Board of Appeals

Ex parte Bunpei Yoshiki

Application for Patent filed September 9, 1937, Serial No. 163,159. Mullitic Cast Refractories Having an Extremely Low Coefficient of Thermal Expansion.

Messrs. Dorsey, Cole & Garner for appellant.

This is an appeal from the action of the Primary Examiner finally rejecting claims 1 to 6, inclusive.

Claims 1 and 2 are illustrative and read as follows:

1. The hereinbefore described method of producing a body containing mullite, corundum and cordierite which comprises melting a batch containing alumina, silica, and magnesia and being substantially free from alkali.

2. The hereinbefore described refractory product consisting of mullite and corundum crystals with a cordierite matrix.

The references relied upon are:

Hauman 1,966,406 July 10, 1934

Hauman 1,966,407 July 10, 1934

The patents to Hauman disclose a refractory product consisting of mullite and corundum crystals bonded by a glassy matrix. The product is formed by fusing together alumina, silica and magnesia in the same relative amounts as in the application.

The examiner takes the position that the batches and treatment being the same in the patents as in the application, the resulting product will also be the same, and the matrix of the patents will also contain cordierite. Applicant points to the small alkali content of his product, but we are not satisfied Hauman's product contains a substantially greater amount of alkali. In any event, we believe the disclosures in the patents are too pertinent to admit of allowance of the claims on appeal.

The decision of the examiner is affirmed.

Board of Appeals

EUGENE LANDERS

Examiner-in-Chief

E. T. MORGAN

Examiner-in-Chief

J. W. CLIFT

Examiner-in-Chief

May 10, 1941

Messrs. Dorsey, Cole & Garner
1346 F Street, N. W.
Washington, D. C.

UNITED STATES
COURT OF APPEALS FOR THE
DISTRICT OF COLUMBIA

FILED AUG 18 1943

Joseph W. Sturges

BRIEF FOR APPELLEE

CLERK

United States Court of Appeals for the
District of Columbia

APPEAL No. 8531

CORNING GLASS WORKS, APPELLANT

v.

CONWAY P. COE, COMMISSIONER OF PATENTS, APPELLEE

APPEAL FROM THE JUDGMENT OF THE DISTRICT COURT OF THE
UNITED STATES FOR THE DISTRICT OF COLUMBIA

W. W. COCHRAN,
Solicitor, United States Patent Office,
Washington, D. C.,
Attorney for Appellee.

E. L. REYNOLDS,
Of Counsel.

INDEX

	Page
Introduction.....	1
Appellant's Application.....	1
The Hauman Patents.....	2
The Appealed Claims.....	2
Summary of Argument.....	2
Argument.....	2
Conclusion.....	11

(I)

**United States Court of Appeals for the
District of Columbia**

APPEAL No. 8531

CORNING GLASS WORKS, APPELLANT

v.

CONWAY P. COE, COMMISSIONER OF PATENTS, APPELLEE

***APPEAL FROM THE JUDGMENT OF THE DISTRICT COURT OF THE
UNITED STATES FOR THE DISTRICT OF COLUMBIA***

BRIEF FOR THE COMMISSIONER OF PATENTS

INTRODUCTION

This is an appeal from the judgment of the District Court of the United States for the District of Columbia (App. 34)¹ dismissing appellant's complaint brought under Section 4915 R. S. (U. S. C. title 35, sec. 63) to authorize the Commissioner of Patents to issue to appellant a patent containing claims 1 to 6, inclusive, of the application of Yoshiki, Serial No. 163,159.

APPELLANT'S APPLICATION

Appellant's application (App. 47) discloses the production of a refractory product by the use of silica,

¹ NOTE.—The numbers in parentheses refer to pages in appellant's appendix.

alumina, and magnesia in certain proportions, and states that the alkali content should be kept below 0.1% of the batch. One example given of the contents of the batch, prior to melting, is 70% alumina, 25% silica, and 5% magnesia.

THE HAUMAN PATENTS

The references relied on are two patents to Hauman, Nos. 1,966,406 and 1,966,407, each of which discloses the production of a refractory product by the use of an initial mix having, as the ratio of "important ingredients," alumina 70%, silica 25%, and magnesia 5%.

THE APPEALED CLAIMS

The appealed claims appear on page 5 of appellant's brief and on page 3 of the appendix thereto.

SUMMARY OF ARGUMENT

1. The only alleged difference between appellant's process and product and those of the Hauman patents resides in the alkali content.

2. The alkali content contemplated by the Hauman patents is substantially that specified by the appealed claims.

ARGUMENT

The disclosure of the Yoshiki application here involved is extremely brief, and the actual steps to be followed are not set forth. The applicant merely states that the usual batch for electro-melting for casting refractories contains more than 1% of alkali and that he has found that if the alkali content is

reduced to 0.1% or under a better product is obtained. He also gives typical batch compositions. There is no disclosure whatever as to how the melting and cooling are to be carried out, and it must, therefore, be assumed that, if the compositions given are used, any conventional melting process will produce the desired product. Obviously, if some specific melting conditions were required, it would be necessary to specify them in the application and the disclosure would, otherwise, be insufficient. It follows that Yoshiki discloses merely that a certain batch composition will produce an improved product and, unless this composition is new and involves invention, the appellant is not entitled to a patent.

One of the two batch compositions which Yoshiki gives as suitable comprises 70% of alumina, 25% of silica, and 5% of magnesia. These same ingredients in these identical proportions are disclosed by each of the Hauman patents. Further, as already noted, Yoshiki discloses no method of melting or cooling differing from that of Hauman. The appellant does not appear to deny these facts, but argues that Hauman uses more than 0.1% of alkali, and that this results in a product differing from that of Yoshiki.

It is thought to be clear that alumina, silica, and magnesia are intended to be the only ingredients present in any material amount in Hauman's batch. It will be noted in the first place that the proportions of these ingredients add up to 100%, which suggests that no appreciable amount of anything else is present. Further, in patent No. 1,966,406, page 1, line 47 et seq.,

it is stated that the silica *in the melt* may be up to 25% and on the same page, line 96 et seq., it is said that the magnesia component *of the melt* may be "say 5%," and some of the claims of the patent, as, for example, claim 1, state that the magnesia is "approximately 5% of the batch." Since silica and magnesia are listed at 25 and 5 respectively in the ratio of important ingredients, it seems clear that the patentee regards this ratio as being, in effect, a table of percentages of the batch.

Patent No. 1,966,406 also states (page 1, line 92) that the magnesia content may be as low as 2½% of the batch. Obviously, if an ingredient comprising this amount is one of the three "important ingredients," it is not contemplated that any very considerable amount of other materials will be present.

Further, in patent No. 1,966,407, page 1, lines 85 to 95, the patentee discusses the use of alkalis (Sodium, potassium) and alkaline earths (e. g. magnesia). He suggests that if a product having a high melting point is desired "members of the alkaline earth group" should be used; that if a low melting point is desired "members of the alkali group" should be used, and that for an intermediate melting point "members of the alkaline earth oxide group may be combined with one or more members of the alkali group." This language seems to admit of no other reasonable interpretation than that, when a high melting point is desired, alkaline earth materials are used *alone*. Certainly if the patentee had contemplated that there would always be several percent of alkali in his batch,

as the plaintiff insists there must be, he would not have referred to the alkaline earth group in contradistinction to a mixture of that group with alkali. Clearly, the teaching of this patent is that the alkaline earths raise the melting point while the alkalis lower it and that to obtain the highest melting points one should use no alkali in the batch.

Against these clear indications that Hauman does not use and does not intend to use any appreciable amount of alkali in his melt, his patents contain, on their face, nothing which expressly or impliedly suggests that alkalis are to be present when the alumina-silica-magnesia mix is used. The plaintiff calls attention to the statement in patent No. 1,966,407 (page 2, lines 85 to 89) that the typical glass contains 10% of impurities. Obviously, however, such impurities need not contain any alkali. In fact, it would seem that they might consist of other combinations of the aluminum, silicon, magnesium, and oxygen contained in the "important ingredients."

The appellant's witness, Field, appeared to argue (29, X Q. 123) that the impurities referred to were impurities in the starting materials. This position seems clearly untenable. If impurities were present in amounts up to ten percent they would certainly rise to the dignity of "important ingredients, and would have been listed as such. Moreover, such impurities, regardless of amount, would not necessarily include any alkali. This was expressly conceded by Field (X Qs. 124 to 126). Yoshiki does not mention impurities other than alkalis and there is nothing to

show that his starting batch contains any less quantity of such other impurities than the conventional batches. Hauman's reference to impurities in general, therefore, has no bearing on the amount of alkali which may be present in his batch.

If the plaintiff is to demonstrate, therefore, that Hauman uses more than 0.1% of alkali, it must be done by evidence extrinsic to the patents themselves. The only such evidence offered was the testimony of the witness, Field. This witness testified rather vaguely as to certain experiments allegedly performed by him or under his direction. He testified solely from recollection and produced no records of the alleged experiments. The result was that his testimony consisted largely of conclusions rather than of the facts on which the conclusions were based.

The testimony of the witness was to the general effect that since Hauman intends to get a low-mullite content, he must have had some alkali as well as the stated amount of magnesia in his mix, since this magnesia would not eliminate mullite. However, Hauman does not necessarily eliminate mullite, but states that as much as 15% of it is not commercially objectionable. Moreover, alkalis are not the only materials which will reduce the mullite content. Alkaline earths, such as magnesia, have the same effect. The absence of mullite, therefore, affords no clear evidence that alkalis were present.

It is to be noted that the Yoshiki application contains no statement whatever as to the actual amount of mullite present in the final product. So far as appears, this amount need be no greater than that al-

lowed by Hauman. Moreover, Hauman recognizes that mullite crystals may be desirable for some purposes since he states in patent No. 1,966,407, page 2, lines 93 to 95 (43) that they "give to the glass a remarkable mechanical and refractory strength." He also states, in the same patent, page 3, line 24 et seq. (44) that the proportions of materials "may vary largely according to the particular characteristics wanted in the ultimate product."

There is no suggestion in either the Yoshiki application or the Hauman patents that the amount of alkali has any effect on the mullite content of the product, and the record certainly does not show that alkali is the only thing which will affect this content. Accordingly, in the clear absence of any express statement by Hauman that he intends to include alkali for this or any other purpose, Field's speculation as to the amount of this material which might be present is clearly insufficient to justify the setting aside of the finding of the lower Court that both the application and the references use the same ingredients.

It is submitted that the interpretation of the references should be based on what they actually say rather than on inferences as to what they may have intended. Certainly no one following the Hauman patents would suppose that any large amount of alkali should be included. On the contrary, for the reasons above given, the clear purport of these patents is that no appreciable amount of alkali is to be used. Hauman states (43) that his mixture of raw materials may *consist of* Bauxite, silica sand, and magnesia. This means that no other ingredients are used. Accordingly, any

alkali present could come only from the Bauxite. Ordinary commercial Bauxite contains 0.2% of alkali (Field X Qs. 69 and 70) and since the Bauxite comprises only 70% of the batch, the amount of alkali, as compared with the total batch would be 0.14%. In other words, following the express teaching of Hauman and using ordinary commercial materials, one would have 0.14% of alkali, whereas the Yoshiki application states that 0.1% or under is desirable.

Field, in his attempt to show that Hauman uses more than 0.1% of alkali, reasons back from certain products which Hauman says he obtains and draws inferences which, as already noted, are not well supported, as to what the starting batch must have been. This, of course, is not the normal procedure. Hauman states exactly what ingredients are to be used and exactly what proportions are employed. Anyone desiring to carry out the process would use these ingredients, obtained from normal sources, in the proportions specified. He would not theorize as to whether, when Hauman mentioned Bauxite, he meant a Bauxite abnormally high in alkali. Hauman has disclosed certain definite steps and, if these steps, as normally carried out, would produce appellant's product, the Hauman disclosure anticipates the product. If Hauman was mistaken as to the amount of mullite contained in his product when Bauxite was used, this is not material. He has disclosed a definite process and hence has disclosed the resultant product. This process and product cannot be repatented by a later inventor merely on the suggestion that the specific analysis given by Hauman is inaccurate.

There is nothing of record to indicate that there is any material difference between 0.1% and 0.14% of alkali. No comparative tests of these values were made and the witness Field indicated (X Qs. 78 and 95) that he would not expect the results to be greatly different. It follows that the trial Court was correct in holding that there is no material difference between the materials used by Hauman and those used by Yoshiki, even if Hauman uses what Field considered "ordinary commercial Bauxite." Moreover, Field stated (App. 25, 26) that the company by which he was employed had endeavored, for at least ten years, to keep down the alkali content of its melts, and had used Bauxite having 0.2% or less of alkali, which Bauxite is commercially available. No reason appears for supposing that Hauman, or anyone else working in this art, should follow a different practice in the selection of Bauxite. The products with which Hauman and Yoshiki are concerned would ordinarily require a uniformity of composition and it would be expected that reasonably pure ingredients would be used. It would, therefore, be reasonable to suppose that Hauman would use even less than 0.14% of alkali.

It will thus be seen that the Hauman patents clearly indicate that when the alumina-silica-magnesia mix having proportions of 70-25-5 is employed, no material amount of alkali is intended to be present. It further appears that it would be a simple matter to avoid such alkalis by selecting the proper commercial grade of bauxite, and that this grade is the one commonly used by at least one company working in

the art to which the present alleged invention relates, there being no evidence as to any other grade being used by other companies in this field. Under these circumstances it is submitted that a skilled worker following Hauman's teachings would, in the ordinary course of events, produce what is claimed by Yoshiki, and that the claims here involved are, therefore, unpatentable.

It is to be noted that the Yoshiki process and product are not being used commercially and that there is no evidence that they are superior to those of Hauman. Accordingly, even if Yoshiki did produce a somewhat different product, this alone would not entitle him to a patent. Mere variations in proportions of ingredients which change, without substantially improving prior products are not patentable inventions. It is only when some unobvious procedure is followed and an unexpected result is produced that invention is involved. So far as the record shows Yoshiki has, at the best, merely discovered that if he uses less alkali he will get a different product. This is not enough to entitle him to a patent.

It should be noted that Field, in his alleged comparison tests on the Yoshiki and Hauman processes saw fit to employ Bauxite in the Yoshiki process and diasporic in the Hauman process, although Hauman expressly states in patent No. 1,966,407 that Bauxite may be used and, in fact, mentions it before diasporic. Field admitted (X Q. 63) that he did not try the Hauman process with Bauxite. Since diasporic contains about 1.7% or more of alkali, while Bauxite

contains only 0.2% it is evident that the witness selected for his comparison the alternative which was more remote from the Yoshiki disclosure, and that he refrained from trying the closer alternative. Obviously, since Hauman expressly suggests the use of Bauxite, his disclosure is anticipatory if the use of Bauxite will result in the process and product claimed. Whether the alternative use of diaspore will produce the same effect is of no consequence; the value of the disclosure of Bauxite is not lessened by the fact that diaspore also is suggested. It follows that Field's testimony as to the use of diaspore is of little or no value so far as the present issue is concerned.

CONCLUSION

It is submitted that the Hauman patents disclose the same process as the Yoshiki application and that the materials specified by these patents are the same and in the same proportions as those of Yoshiki. It follows that the product and process of the patents must be the same as those of the application, and that the trial Court properly dismissed the complaint.

Respectfully submitted.

W. W. COCHRAN,
Solicitor, United States Patent Office,
Washington, D. C.,
Attorney for Appellee.

E. L. REYNOLDS,
Of Counsel

AUGUST, 1942.

REPLY BRIEF FOR APPELLANT.

IN THE
United States Court of Appeals
FOR THE DISTRICT OF COLUMBIA.

FILED SEP 28 1943

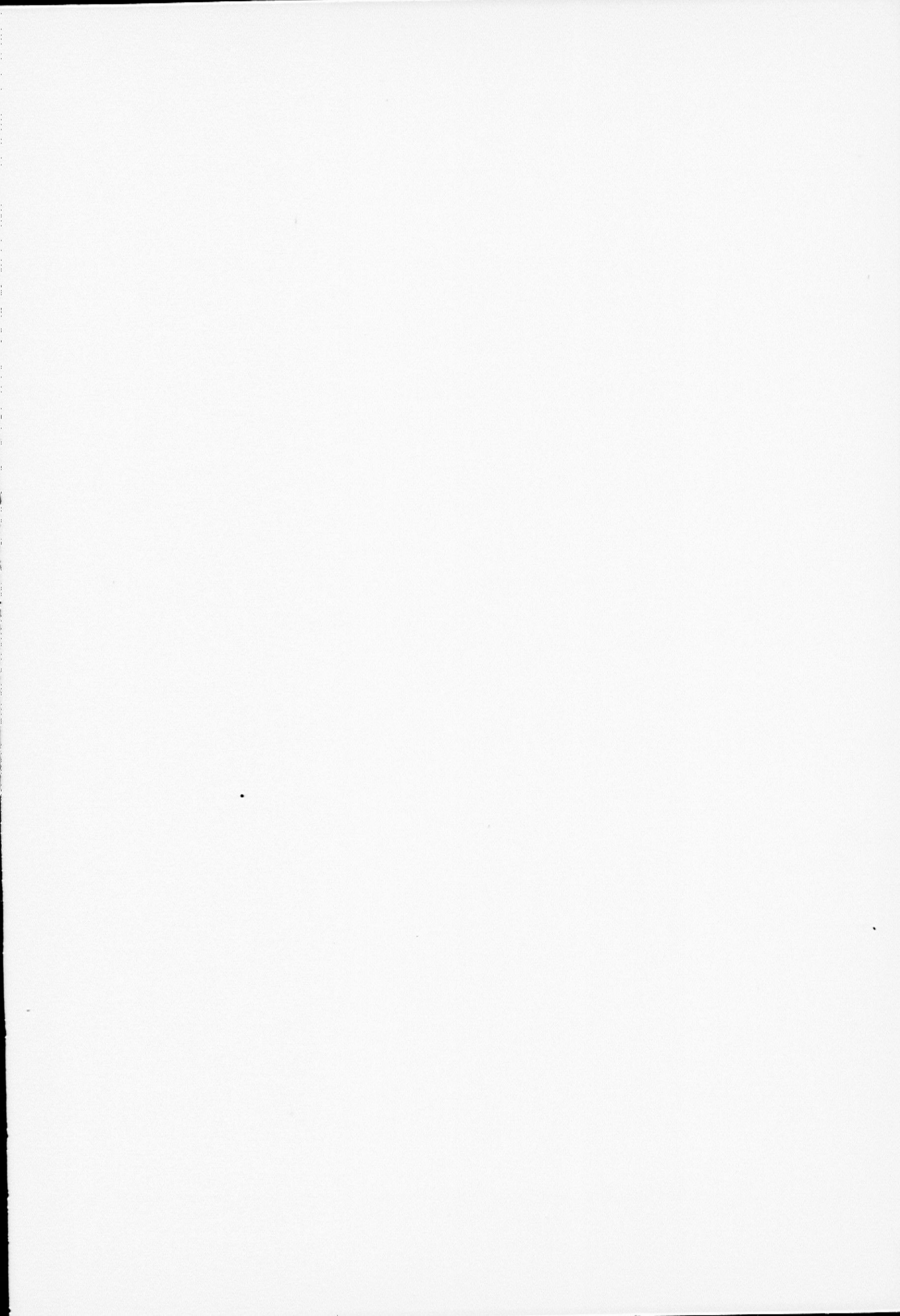
Joseph H. Starnes

CLERK

No. 8531

CORNING GLASS WORKS, *Appellant*,
v.
CONWAY P. COE, COMMISSIONER OF PATENTS,
Appellee.

V. M. DORSEY,
Counsel for Appellant.



IN THE
United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA.

No. 8531.

CORNING GLASS WORKS, *Appellant*,

v.

CONWAY P. COE, COMMISSIONER OF PATENTS,
Appellee.

REPLY BRIEF FOR APPELLANT.

We regret that the nature of Defendant's brief requires a reply of this length. That brief is significant in what it omits to discuss. It entirely neglects to present to the Court what would be the result if the aluminous material used in the Hauman batch is "DIASPORE", expressly named by Hauman as the equivalent of bauxite, and which generally contains as much as 3 per cent alkali (Field, Q. 25) and is never as low as 1/10th of 1 per cent (Field, Q. 55). It is bottomed on the improbable case of one following the teachings of Hauman to get Hauman's result carefully and intentionally selecting a most unusual type of bauxite instead of the usual type seldom

containing less than 2/10ths of 1 per cent alkali (Field, XQ. 70).

It furthermore entirely neglects to point out that to obtain a mullite content of 15 per cent mentioned by Hauman as the upper limit of that constituent in his product one must have alkali present in his batch.

Defendant bottoms its whole case upon the chance that one having the Hauman patents before him would not only select bauxite, but bauxite of lowest alkali content and thus obtain the Yoshiki result.

This, however, is not sufficient for anticipation. As was said by the 2d Circuit Court of Appeals in *Catalin Corp. v. Catalazuli Mfg. Co.*, 79 Fed. (2d) 593, 596," * * * anticipation must speak affirmatively and with certainty; must disclose the invention without debate."

This court in *Beckett v. Coe*, 98 F. 2d 332 discussed at length the authorities on certainty and quoted with approval the statement from *American Stainless Steel Co. v. Ludlum Steel Co.*, 290 F. 2d 103, that to constitute anticipation "It is necessary to show with reasonable certainty how the desired result can be accomplished."

Certainly the Hauman specifications do not show applicant's batch with this certainty and certainly there is no hint in Hauman of applicant's final product.

Defendant's brief (p. 3) says that the Yoshiki batch "comprises" alumina, silica and magnesia, and that Hauman discloses these. We submit that the Yoshiki batch as claimed *consists* of alumina, silica and magnesia, and that the Hauman batch *comprises* these. As was said by the Board of Appeals in the Patent Office many years ago (*ex parte Doller*, 12 U. S. P. Q., 38), "the word 'comprising' does not exclude other materials besides wood and grains. The word 'consisting' would confine materials strictly to wood and grain."

In short, this difference between "consisting" and "comprising" is one of the differences between the Hauman and the Yoshiki batches.

After thus improperly stating the Yoshiki batch, defendant's brief (pp. 3-4) makes a labored attempt to establish that by the stated ratio of important ingredients Hauman meant percentages of total and all ingredients. We have shown the distinction between the two on the bottom of page 7 of our main brief. That Hauman's figures may happen to add up to 100 does not mean that merely alumina, silica or magnesia are present in the batch in view of the explicit statement of the presence of 10 per cent of impurities in the glass (page 8 of our main brief).

Defendant attempts (D. B. p. 5) to avoid the effect of this by evolving out of the inner consciousness of its counsel that these impurities might consist of other combinations of the aluminum, silicon, magnesium and oxygen contained in the important ingredients. Field (XQ. 123, p. 29) testified that to him, as an expert, by impurities Hauman "obviously refers to any impurities in his starting materials."

Defendant's brief on page 5 contains a serious error in referring to 10 per cent of impurities having reference to batch. It has reference to the glass and amounts to only 2½ per cent of the batch (Q. 24, p. 18).

We quote as follows from page 5 of Defendant's brief:

"Moreover, such impurities, regardless of amount would not necessarily include *any* alkalies. This was expressly conceded by Field (XQs. 124-126)."

To show the looseness of quotations and assertions in defendant's brief we here copy the questions referred to:

"XQ. 124: And if you had 3/10th's of 1 per cent, say, of alkali in their (there) would that account for the 1 per cent of impurities? A. No.

"XQ. 125: So the impurities are largely something else than alkali? A. They may be.

"XQ. 126: So the fact that there is 10 per cent of impurities is not any indication of the alkali content of the ore, is it? A. No."

The whole argument of Defendant herein seeks to establish the possibility and the probability of the presence of

impurities other than alkali in the Hauman batch is a concession that the raw clay materials used by Hauman did not consist of alkali solely but contained other impurities usually present in such material. This is our contention, and the Record shows that alkalies are among these. How then can the defendant contend that Hauman teaches with certainty and clearness that his clays shall not contain alkalies?

On page 6 defendant states that Field testified rather generally, etc., about some experiments made by him without producing any records. This has probably reference to the following:

(a) Field testified on direct that he had cast Plaintiff's Exhibit 1 by following the teachings of Yoshiki in selecting as his source of alumina a bauxite having the lowest alkali content he could find and that even then he only got by "by the skin of his teeth". Testimony as to this is Q. 30 and XQ's. 36 to 46, and 56.

(b) Field testified in answer to a question by the Court on direct that he had made melts after the Hauman formula, using diaspore, and obtaining the Hauman results. (Testimony as to this are Q's 31 and XQ's 51-68).

It will be noted that the cross examiner called for no notes and for no records.

On pages 6 and 7 defendant makes much of the point that Hauman does contemplate the possibility of the presence of some percentage of mullite in the product, and that as Yoshiki contains mullite the end products are the same and, therefore, that the batch materials are the same. This entirely disregards the fact that Yoshiki's product by its claims contains substantial percentage of mullite and cordierite and does not contain over 1/10th of 1 per cent of alkali. It also neglects the fact that as testified by Field (XQ. 106), for Hauman to get as low as 15 per cent mullite, which is the maximum he states may be present according to his invention, requires the presence of alkali in addition to the presence of the magnesia (Field, XQ. 106, p. 27).

The defendant's brief (p. 7) says:

"There is no suggestion in * * * the Hauman patents that the amount of alkali has any effect on the mullite content of the product."

We cannot understand how counsel can make such an assertion. The Hauman patent 1,966,407 (Appendix, p. 42) after stating that "* * * a molten mass of alumina and silica will form mullite with little or no corundum" (lines 60 and 62) says:

"I prevent such mullite formation while at the same time permitting the free growth of corundum crystals by the *use of a counter-balancing* or absorption preventing agent which I add to the normal mullite yielding alumina-silica mix before or during the fusion of the mix. *Such agents * * * may be any of the oxides of the alkali metals* such as potassium, sodium, lithium, rubidium and cesium * * *. (Lines 72 to 84.)

Again, defendant says that the record certainly does not show that alkali is the only thing which will effect that (mullite) content. This is erroneous. We refer to Field (Q. 32, p. 20) in which we are specifically told that neither iron oxide nor titanium oxide is effective as mullite suppressers and to (Q. 123, p. 29) where he says that these, together with the alkali, are the impurities present in bauxite and diaspore.

Defendant says (p. 7):

"Certainly no one following the Hauman patent would suppose that *any large amount of alkali* should be included."

Certainly one following the teachings of Hauman would introduce enough alkali to accomplish the result Hauman had in mind and also certainly he would not take pains to avoid a large amount of alkali, stated by Hauman to be compatible with his process and product. However, the question is not whether he would endeavor to introduce a *large*

amount of alkali; it is whether he would go to the *extraordinary pains in preventing the introduction of more than 1/10th of 1 per cent of alkali*. That this would involve extraordinary pains is shown by the testimony of Field.

Again, a false idea is conveyed by the defendant in alleging as he does, "Hauman states that his mixture of raw materials may consist of bauxite, silica and sand. This means that no other ingredients are used."

What Hauman says is that his mixture "consists of aluminous ores such as bauxite or *diaspore*, silica and sand and a counterbalancing agent * * * such as magnesia" (p. 43). The very word "aluminous", if it does not imply the presence of other ingredients than alumina, includes such presence and the Record shows that bauxite and diaspore sometimes run as high as 3 per cent alkali. The introduction of any alkali that may be present in his ores is clearly contemplated and anticipated by Hauman.

We regard the omission by the defendant of the word "diaspore" from the matter above quoted from his brief as significant and unfair; for while commercial bauxite may be found that contains not over 2/10th's of 1 per cent of alkali, diaspore often runs 3 per cent of alkali (Appendix 18, Q. 25) and that in use at the date of Hauman usually contains 1.7 per cent alkali (XQ. 53, p. 22).

But Hauman suggests using bauxite and diaspore indifferently. Inasmuch as page 8 of defendant's brief, and indeed all of defendant's brief, is bottomed on the supposition that bauxite is the only aluminous material that one following the teachings of Hauman would use, that page has no argumentative value.

On page 9 the substance of defendant's argument is that: (a) as some bauxites contain as little as 2/10th's of 1 per cent of alkali; and that (b) there is no functional difference in using a bauxite of 1/10th or 2/10th's of 1 per cent, and that (c) one following the Hauman teaching would use such low alkali bauxite and not other bauxites, some of which contain as much as 3 per cent alkali.

We answer:

(a) That the Record does not support the averments made or the arguments drawn therefrom in the brief. We quote the following from the Field testimony:

Q. 44. "Just what was the percentage of alkali in the bauxite used in that test (i. e., making the Yoshiki block)?" (Plaintiff's Ex. 2.)

A. "It was such that the 75 per cent bauxite used contributed 1/10th of 1 per cent of alkali metal oxide to the composition."

"Q. 47. You selected the proper bauxite?

"A. Yes. Even the best bauxites contain usually more than 1/10th of 1 per cent of the alkali metal oxides; and we selected a particular bauxite and obtained the maximum alkali permitted by Yoshiki; and we got by by the skin of our teeth.

"Q. 68. And if you used commercial bauxite in carrying it out, would you get Yoshiki's results?

"A. Not if you used the type of bauxite we use.

"XQ. 70. How much alkali is in it?

"A. Usually 2/10th's of 1 per cent.

"XQ. 73. If you used bauxite containing 2/10th's of 1 per cent in the Hauman process what results would you get?

"A. You would get a glassy matrix which would contain a suitable lower percentage of mullite and the batch would have a higher coefficient of thermal expansion than if the matrix was cordierite.

"XQ's. 74, 75. Would it have cordierite in it?

"A. It would depend on how carefully and how slowly it was cooled down. As commercially made it would not contain cordierite.

"XQ. 77. Would it contain cordierite if you used 1/10th of 1 per cent of alkali?

"A. It gave a matrix which has an analysis similar to that given in the literature for cordierite.

"XQ. 95. Well, now, if you were carrying out the process of Hauman using bauxite having 2/10th's of 1 per cent of alkali you might get Yoshiki's result, is that right?

"A. You would approach those limits.

On page 10 defendant as a last resort misstates the law as to patentability. He urges:

(a) That as the Yoshiki process has not been used commercially there is no patentability. This is not supported by any case we know of. On the contrary, in the issue of the "Patent Trade Mark and Copyright Weekly" (United States Patents Quarterly) reports which comes over counsel's desk as he is writing this brief, we find the following:

"We are not much impressed by the charge that it is a mere paper patent or that it has never been used. If merit lies in it validity cannot be refused because of lack of use." (*Universal Oil Products Co. v. Globe Oil & Refining Co.*, 58 U. S. P. Q. 504-509, C. C. A. 7.)

The Commissioner did not deny in his answer that the Yoshiki product was useful. As stated by Field, the great bulk of bauxite (and bauxite and diaspore are the aluminous materials available when one needs as low as 1/10th of 1 per cent of alkali) is used in the manufacture of aluminum (RDQ. 129).

The Court knows the restrictions imposed by priority orders on materials necessary for war and defense purposes.

(b) It is urged that there is no evidence that the Yoshiki product is superior to that of Hauman and, accordingly, even if Yoshiki's product is different it would not entitle him to a patent. The Supreme Court in *Seymour v. Osborne*, 11 Wall. 516, said:

"Improvements for which a patent may be granted must be new and useful, within the meaning of the patent law or the patent will be void, but the requirement of the Patent Act in that respect is satisfied if the combination is new and the machine is capable of being beneficially used for the purpose for which it was designed, as the law does not require that it should be of such general utility as to supercede other inventions in practice to accomplish the same object."

(See also Walker on Patents, Deller's edition, p. 315).

(c) It is urged that mere variation in proportions of ingredients is not patentable invention. Here we have Yoshiki producing a cordierite binder instead of a glassy one. The changes in proportion are therefore critical.

(d) It is urged that, "So far as the Record shows, that Yoshiki has, at best, merely discovered that if he uses less alkali he will get a different product. This is not enough to entitle him to a patent".

To state this is to answer it.

We submit that the decree below should be reversed.

Respectfully,

.....
V. M. DORSEY,
Counsel for Appellant.